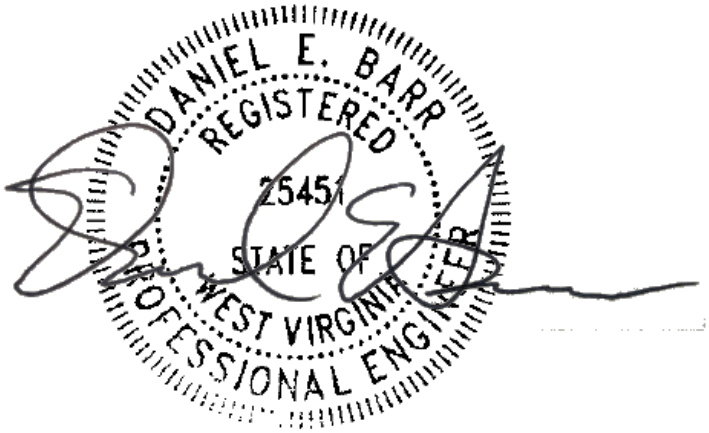
BID SET

Procurement of Dewatering Equipment

City of Wheeling, WV

May 2026



0000038009P

verdantas
8150 Sterling Ct. | Mentor | OH | 44060 |
440.951.9000 | www.verdantas.com

CITY OF WHEELING OFFICIALS

ADMINISTRATION

Denny Magruder, Mayor

Robert Herron, City Manager

William Lanham II, Assistant City Manager

Chelsea Brown, Administrative Assistant

Nathan Greene, Finance Director

Marcia Embrey, Utility Accountant

Rosemary Humway-Warmuth, City Solicitor

Travis Workman, Interim City Engineer

Mike Chiazza, Water Pollution Control Plant Superintendent

Lori Siburt, Water Department Superintendent

COUNCIL

Tony Assaro, Ward 1

Ben Seidler, Ward 2

Connie Cain, Ward 3

Jerry Skalvounakis, Ward 4

Ty Thorngate, Ward 5

Dave Palmer, Ward 6

Jessica Holloway, City Clerk

ADVERTISEMENT FOR BIDS/PUBLIC NOTICE TO BIDDERS

Sealed proposals will be received by the City of Wheeling, WV at the office of the City Manager, 1500 Chapline Street, 3rd Floor, Wheeling, WV 26003 until 12:00 p.m. on May 28, 2026 and will be opened and read immediately thereafter for the

PROCUREMENT OF DEWATERING EQUIPMENT

COMPLETION DATE: 270 DAYS FROM NOTICE TO PROCEED

The bid specifications, drawings, plan holders list, addenda, and other bid information (**but not the bid forms**) may be viewed and/or downloaded for free via the internet at https://bids.verdantas.com . The bidder shall be responsible to check for Addenda and obtain same from the web site.

Bids must be in accordance with drawings and specifications and on forms available from Verdantas LLC at a non-refundable cost of Forty-Five Dollars ($45.00) for hard copies and Forty-Five Dollars ($45.00) for electronic files. Documents may be ordered by registering and paying online at https://bids.verdantas.com. Please contact planroom@verdantas.com or call (440) 530-2351 if you encounter any problems viewing, registering, or paying for the documents.

Publish: *The Intelligencer & Wheeling News-Register*
May 14, 2026
May 21, 2026

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SECTION 1
BID DOCUMENTS

INSTRUCTIONS TO BIDDERS

PART 1 GENERAL

1.1 All questions during bidding should be addressed to Lukas Skelly, who can be reached at Verdantas LLC, V0000038009@verdantas.com

1.2 Sealed bids shall be received by the Owner at the location specified and until the time and date specified in the Advertisement for Bids/Public Notice to Bidders.

1.3 Each bid shall contain the full name and address of each person or company interested in said bid. If no other person be so interested, the Bidder shall distinctly so state the fact.

1.4 Bid forms must be completed in ink or by typewriter. Any corrections to the bid forms prior to submission must be initialed by the person signing the bid. Failure to submit any bid form(s) or other required document(s) may be cause for rejection of the bidder's bid at the sole discretion of the Owner.

1.5 Bids by Corporations must be executed in the corporate name by the President, Vice President, or other officer accompanied by evidence of authority to sign and the corporate seal must be affixed and attested by the Secretary on the Corporate Resolution form.

1.6 Bids by partnerships must be executed in the partnership name and signed by a partner, whose title must appear under the signature.

1.7 All names must be typed or printed below the signature.

1.8 The bid shall contain an acknowledgment of receipt of all Addenda.

1.9 If a Bidder wishes to withdraw his bid prior to the opening of bids, he shall state his purpose in writing to the Owner before the time fixed for the opening, and when reached it shall be handed to him unread.

1.10 After the opening of bids, no Bidder may withdraw his bid for a period of 90 days.

PART 2 EXAMINATION OF CONTRACT DOCUMENTS

2.1 Before submitting a bid, each Bidder must

A. Examine the Contract Documents thoroughly.

B. Familiarize himself with Federal, State, and local laws, ordinances, rules, and regulations that may in any manner affect cost, progress, or performance of the work.

C. Study and carefully correlate Bidder's observations with the Contract Documents.

2.2 The submission of a bid will constitute an incontrovertible representation by the Bidder that he has complied with every requirement of this section and that the Contract Documents are sufficient in scope and detail to indicate and convey understanding of all terms and conditions for performance of the work.

PART 3 BIDDER'S QUALIFICATIONS

3.1 As part of the bid review the Owner may request that the Bidder provide information relating to similar material supplied within the past five years. Bidders experience shall demonstrate capabilities to undertake this type of project.

3.2 Bidder shall provide pertinent information to the Owner relative to any pending suits or outstanding liens. If no information is provided by the Bidder, the Owner shall assume that any such suits or liens do not exist.

PART 4 BID REVIEW BY OWNER

4.1 The Owner reserves the right to reject any and all bids, to waive any and all informalities, and to disregard all nonconforming, nonresponsive or conditional bids.

4.2 All extensions and totals of unit prices and quantities submitted as part of the bid shall be considered informal until verified by the Owner. All bids must be made on the forms contained herein and the bid prices must be written therein, in figures only. Unit prices shall be separately written for "Unit Price" and "Item Total" for each item listed. Should an error in addition and/or multiplication be determined while checking the Bidder's math and verifying his total bid, the "Unit Price " figure shall govern in determining the correct "Item Total." Each Bidder must bid on all Items contained in the Bidding Forms. All bids not in conformity with this notice may be considered informal and may be rejected.

4.3 In evaluating bids, the Owner may consider:

A. The qualifications and experience of the Bidder.

B. Financial ability and soundness of the Bidder.

C. Completeness of all bid forms and bid requirements.

D. Alternates and unit prices requested in the Bid Forms.

E. Unit prices or schedules of values that are or appear to be unbalanced.

F. Previous contractual experience with the Owner.

G. Whether or not the bid package complies with the prescribed requirements.

H. Any other matter allowed by law or local ordinance or resolution.

4.4 Owner may conduct further investigations as he deems necessary to assist in the evaluation of any bid and to establish the responsibility, qualifications, and financial ability of the Bidders, proposed Subcontractors, and other persons and organizations to do the work in accordance with the Contract Documents to Owner's satisfaction within the prescribed time.

4.5 Owner reserves the right to reject the bid of any Bidder who does not pass any such evaluation to Owner's satisfaction.

4.6 The Contract award shall be based on the lowest and best bid or lowest responsive and responsible bid (as applicable for the public contracting agency receiving bids) for the base bid and selected alternate items (if any) for this project.

PART 5 BID SECURITY

5.1 Each bid must be accompanied by a certified or cashier's check in the amount of 10% of the amount bid, an irrevocable letter of credit in the amount of 10% of the amount bid or an original bid bond in the amount of 10% of the amount bid. The certified or cashier's check, or irrevocable letter of credit shall be from a financial institution authorized to transact business in the State of Ohio and acceptable to the Owner. The bond shall be underwritten by a Surety Company authorized to transact business in the State of Ohio having an Ohio agent and listed on the most current Department of the Treasury Circular 570, "Surety Companies Acceptable on Federal Bonds."

5.2 The certified or cashier's check, irrevocable letter of credit, or bond shall be made payable to the Owner and shall serve as a guarantee that in the event the bid is accepted and a contract is awarded to the successful Bidder, the contract will be executed by the bidder.

5.3 Failure on the part of the successful Bidder to execute the contract documents will cause the certified or cashier's check, irrevocable letter of credit, or bond to be forfeited to the Owner as damages.

A. If the Owner awards the contract without rebidding, the Bidder (and the Surety on his bond if a bond was submitted) shall be liable to the Owner for a penal sum not to exceed the difference between the low bid and the next lowest bidder or 10% of the amount of the bid, whichever is less.

B. If the Owner does not award the Contract to the next lowest Bidder, but resubmits the project for bidding; the Bidder (and the Surety on his bond if a bond was submitted) shall be liable to the Owner for a penal sum not to exceed the costs in connection with the resubmission of bids or 10% of the amount of the bid, whichever is less.

5.4 Checks or letters of credit for bid security of all bidders will be returned in the manner and timeframe stipulated in the Ohio Revised Code.

PART 6 AWARD AND EXECUTION OF CONTRACT

6.1 After the Owner's legislative body awards the project, the successful bidder will receive the unsigned contract documents. Within 10 days after their receipt, the successful Bidder shall sign and deliver to the Owner said contract documents.

6.2 The Owner shall execute the Contract within 90 days after the day of the bid opening. When necessary and by mutual consent between the Owner and the Successful Bidder, this 90-day period may be extended.

6.3 The date of the Owner's signature on the Contract Agreement shall be the effective contract date.

6.4 The Owner shall execute and deliver to the successful Bidder two (2) sets of fully executed contract documents.

PART 7 NON-COLLUSION AFFIDAVIT

7.1 Each bid must be accompanied by a completed Noncollusion Affidavit provided within the contract documents.

7.2 Where there is reason to believe collusion or combination among bidders exists, the Owner reserves the right to reject the bid of those concerned.

PART 8 DELINQUENT PERSONAL PROPERTY STATEMENT

8.1 Included with the contract documents is a Delinquent Personal Property Statement to be filled out by the successful Bidder.

8.2 The statement shall be sent to both the County Auditor and the County Treasurer. A signed copy shall remain in the contract documents as well.

PART 9 ORIGINAL DOCUMENTS

9.1 All bid forms, contract forms, bonds and any other bid documents or contract documents requiring signatures shall be submitted with original signatures. No photo copies or faxed copies of signed documents shall be accepted.

PART 10 ADDENDA

10.1 The bidder shall be responsible to obtain Addenda from the web at https://bids.verdantas.com

END OF SECTION 05/26

BID FORMS

The bid forms are not available online. The bid forms are available only by purchasing a set of plans and specifications at the location indicated in the Advertisement for Bids/Public Notice to Bidders.

SECTION 2
CONTRACT FORMS

NOTICE OF AWARD

TO: Date: _____, 20___

PROJECT:

You are notified that your Bid which was opened on _____ has been accepted for the Lump Sum Bid in the bid documents.

You are required by the Instructions to Bidders to execute the Agreement within 10 calendar days from the date of this Notice.

Failure to comply with these conditions within the time specified will entitle Owner to consider your Bid in default, to annul this Notice and to declare your Bid Security forfeited.

The Owner will return to you one (1) fully signed copy of the contract documents.

ACKNOWLEDGMENT

Company name here

_____
Name & Tile

_____
Date

PURCHASE AGREEMENT

This Agreement is made this _____ day of _____, 20___ by and between _____ (hereinafter referred to as "Seller") and _____ (hereinafter referred to as "Purchaser").

1. Purchase. Purchaser hereby agrees to purchase and Seller hereby agrees to sell the equipment listed in the Proposal.

2. Installation. Purchaser shall assume responsibility for the installation of the Equipment.

3. Purchase Price. In consideration for the purchase of the Equipment referenced in Paragraph 1, Purchaser shall pay to Seller the unit prices in the bid proposal for the Equipment ordered and delivered in good condition.

Payment in full will be made within 30 days of invoicing for each order or 30 days of delivery, whichever is later.

4. Delivery. Seller shall deliver the above-referenced Equipment upon the premises of Purchaser on or before the contract completion date.

5. Related Documents. The following Exhibits are attached hereto and incorporated by reference and made a part of this Agreement, to-wit:

Legal Notice; Instruction to Bidders; Proposal and Related Exhibits; Contract Forms and Related Exhibits; Standard Technical Specifications and Drawings.

6. Condition to Acceptance. Seller agrees and understands that the delivery of the Equipment shall be subject to the acceptance of the Purchaser upon and in accordance with the Standard Technical Specifications.

7. Warranty. Seller warrants that the Equipment described above are free from defects in workmanship and material for one year commencing on the date that the Equipment is delivered. All defective Equipment shall be replaced with brand new Equipment.

8. Indemnity. Seller hereby agrees to indemnify and hold Purchaser, its agents, officials and employees, harmless from any claim (including without limitation, claims involving strict or absolute liability, tort, product liability or negligence liability), loss, cost, expense or damage of every nature (including attorneys fees) by or to any person as a result of any defective manufacture of the aforementioned Equipment. Seller, however, assumes no responsibility for installation of the aforementioned Equipment.

9. Amendment and Waiver. This Agreement may be amended or modified or any provision thereof may be waived only by instrument in writing executed by the parties.

10. Complete Agreement. This Agreement constitutes the entire agreement of the parties and supersedes any and all other representations or contracts either oral or in writing among the parties hereto with respect to the subject matter hereof. The invalidity or unenforceability of any provision hereof shall not affect the validity or enforceability of the remaining provisions.

11. Jurisdiction. This Agreement shall be interpreted and enforced by the **Court of Common Pleas (West Virginia has Circuit Courts)** , Ohio County, West Virginia.

IN WITNESS WHEREOF, the parties have hereunto executed this Agreement the day and year first above set forth.

PURCHASER,

By:_____
Name & Title

SELLER,

By:_____
Name & Title

I hereby certify that funds in the amount of _____Dollars and _____ Cents ($_____) necessary for the foregoing Contract have been appropriated and are in the Treasury, or are in the process of collection, or are available through grants and/or loans from other funding sources.

BY: _____
Fiscal

Approved as to form:

_____
Legal

DELINQUENT PERSONAL PROPERTY STATEMENT

_____, having been awarded a contract by The City of Wheeling, WV, hereby affirms under oath, that at the time the bid was submitted, my company **was / was not** charged with delinquent personal property taxes on the General Tax List of Personal Property (Personal Property Book) for Ohio County, West Virginia.

If such charge for delinquent personal property tax exists on the General Tax List of Personal Property for Ohio County, West Virginia, the amount of such due and unpaid delinquent taxes, including due and unpaid penalties and interest shall be set forth below.

A copy of this statement shall be transmitted by the Taxing District's Fiscal Officer to the County Treasurer within thirty days of the date it is submitted. A copy of this statement shall also be incorporated into the Contract made between the City of Wheeling, WV and the _____ and no payment shall be made with respect to any Contract unless such statement has been so incorporated as a part thereof.

Delinquent Personal Property Tax	$_____
Penalties	$_____
Interest	$_____

Company name here

_____
Name & Title

Subscribed in my presence, and sworn to before me, this _____ day of _____, 20____.

_____
Notary Public

[SEAL]

THE OWNER OR THEIR AUTHORIZED REPRESENTATIVE SHALL INSERT THE FOLLOWING CONTRACT DOCUMENTATION IN THE EXECUTED CONTRACT:

A) FINDINGS FOR RECOVERY – ORC 9.24
(http://ffr.ohioauditor.gov/)

B1) CHECK FOR DEBARRED CONTRACTORS IN THE STATE OF OHIO
(https://www.sos.state.oh.us/records/debarred-contractors/)

B2) CHECK FEDERAL SAM (System for Award Management) for FEDERAL FUNDING (including sub-contractors), (if applicable)
(https://www.sam.gov/SAM/)

C) NOTIFICATION OF SURETY AND AGENT OF CONSTRUCTION CONTRACT AWARD – ORC 9.32 (if applicable)

REV. 04/26

SECTION 3
SPECIFICATIONS

SECTION 011100 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 LOCATION OF THE PROJECT

A. The project is located in the City of Wheeling, Ohio County, West Virginia. The project site is at the City of Wheeling Water Pollution Control Division (WPCD) located at 2516 Main Street, Wheeling, WV 26003.

1.3 PROJECT SCOPE

A. This project is not subject to Build America, Buy America Act (BABAA) under assistance list # 97.036.

B. The Sludge Dewatering Equipment Procurement project includes the procurement of a complete, fully integrated sludge dewatering packaged system for the City of Wheeling Water Pollution Control Division (WPCD), Wheeling, West Virginia.

C. The scope of this Contract is limited solely to furnishing the complete sludge dewatering equipment system. All installation, construction, demolition, structural, mechanical, electrical, piping, and system integration work will be performed under a separate Construction Contract.

D. Under this Project, the Owner, City of Wheeling WPCD, will directly purchase the sludge dewatering system as a fully coordinated package from a single Vendor. The packaged system shall include all process equipment, accessories, controls, and support components necessary to perform the sludge dewatering operation as specified in the Contract Documents.

E. The Equipment Procurement Project is limited to furnishing the complete sludge dewatering package system only. Installation, construction, demolition, electrical, structural, piping, and integration work associated with the system shall be performed under a separate Construction Contract following completion of this procurement.

F. The Vendor shall be responsible for overall system integration, coordination of individual equipment manufacturers, compatibility of components, system performance, and conformance with the Contract Documents. The Vendor shall furnish all required shop drawings, product data, certifications, warranties, and related submittals in accordance with Section 013323. Manufacturer's field services will be required under a separate Construction Contract.

G. This procurement approach is intended to secure a fully compatible, performance-guaranteed sludge dewatering system prior to construction, reducing installation risk, improving system reliability, and ensuring compliance with the Owner's operational requirements

1.4 DEFINITIONS

A. Vendor: The entity contracting directly with the Owner to furnish the complete, integrated sludge dewatering packaged system. The Vendor shall be the single point of responsibility for overall system coordination, compatibility, performance, warranties, and conformance with the Contract Documents.

B. Manufacturer: The entity that designs and fabricates individual equipment components that form part of the packaged system. Where the Manufacturer is not the Vendor, the Vendor shall remain fully responsible for integration, coordination, and system performance.

1.5 PROJECT DESCRIPTION

A. Scope of Procurement:

1. The Vendor's scope of equipment procurement for the complete sludge dewatering packaged system shall include, but not be limited to, the following major components listed herein.
    a. Fabricating or procuring individual components
    b. Integrating the complete packaged system
    c. Performing factory testing
    d. Preparing equipment for shipment
    e. Delivering all equipment to the Project site

B. Basis of Design

1. The Multi-Disc Screw Press (aka Screw Press) system has been designed based on the Esmil Group Multi-Disc Screw Press, Model MDQ-506(5) CS, which serves as the Basis of Design.

2. Basis of Design equipment defines the minimum acceptable standard of quality, performance, and functionality, and is based on site-specific constraints. Approved equal systems may be submitted in accordance with the Contract Documents

3. The complete sludge dewatering packaged system includes the following major components:
    a. Multi-Disc Screw Press, complete with flocculation tank
    b. Inlet sludge flow meter
    c. Sludge feed pumps, two (2) total
    d. Polymer blending skid systems, two (2) total
    e. Shaftless screw conveyor
    f. Main Control Panel located in the Sludge Handling Building, second-floor Electrical Room

g. Local Control Panel on Multi-Disc Screw Press Skid
h. Spare parts
i. Shipping and delivery
j. Equipment P&IDs

1.6 CONTRACT DOCUMENTS

A. The Contract for equipment procurement consists of one volume of Contract Documents, including, but not limited to: Legal Notice, Table of Contents, Instructions to Bidders, Forms to be completed with the Bid, Contract Forms, General Conditions, Supplementary Conditions, Specific Project Requirements, and the technical specifications, including:

1. Division 01 – General Requirements.
2. Division 43 – Process Liquid Handling for the pumps, material, and installation to be incorporated into the work.
3. Division 46 – Wastewater Equipment materials, equipment, and installation to be incorporated into the work.
4. Section 330900 PLC and HMI Control System.
5. The Major Equipment List for the Sludge Dewatering Improvements – Equipment Procurement Contract is provided in Attachment 1, included at the end of this section.
6. Existing Sludge Pump Local Control Panel Reference Drawings (supporting document).

B. Vendors are advised to familiarize themselves with the complete Equipment Procurement Contract Specifications before submitting a bid.

1.7 DRAWINGS

A. The drawings consist of plans illustrating the equipment included as part of the complete packaged system under the procurement contract for the Sludge Dewatering Improvements Project, including, but not limited to:

1. 00G-01: Cover Sheet Procurement
2. 00G-02: Indes and Symbols
3. 00G-03: Process Sludge Flow Diagram
4. 00G-04: Work Location Map
5. 10S-01: Sludge Handling Building – Second Floor Plan at EL 672.00 – Equipment Footprint
6. 10D-01: Sludge Handling Building – Second Floor Plan at EL 672.00 – Proposed Dewatering Equipment

7. 10D-02: Sludge Handling Building – Dewatering Equipment – Sections A & B
8. 10D-03: Sludge Handling Building - First Floor at EL 658.25 – Proposed Polymer Skid System
9. 10D-04: Sludge Handling Building – Basement Plan at EL 644.50 – Sludge Feed Pumps P11 & P12
10. 10I-001: Screw Press System Architecture Plan

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with Section 016600, Product Storage and Handling Requirements.

B. The Manufacturer shall remain fully responsible for proper packing, protection, and storage of all furnished equipment at the Manufacturer's facility until the General Contractor (aka Contractor) is selected, but not earlier than October 2026, unless otherwise directed by the Owner.

C. Storage shall be in full accordance with the Manufacturer's written storage and preservation requirements.

D. During the Manufacturer-controlled storage period, the Manufacturer shall protect equipment from damage, corrosion, moisture, contamination, and environmental exposure and shall maintain records of all preservation activities

E. At the conclusion of the storage period, the Manufacturer shall transfer the equipment and all applicable O&M Manuals, preservation records, and installation requirements to the Installation Contractor (aka Construction Contractor). Responsibility for handling, storage, and protection shall be transferred at that time.

2.2 SITE ACCESS

A. The City of Wheeling WPCD facility operations staff normally works until 3:00 P.M. Monday through Friday, at which time the main entrance gate is secured. The Vendor/Manufacturer shall coordinate in advance with the Owner to obtain site access for deliveries, start-up activities, or other work occurring outside normal operating hours.

PART 3 - EXECUTION

3.1 MAJOR EQUIPMENT LIST

A. Attachment 1 – Sludge Dewatering Improvements Major Equipment List is included as part of this Specification and identifies the major equipment and system components associated with the Sludge Dewatering Improvements – Equipment Procurement Project.

B. The Major Equipment List defines, for each listed item, the responsible party for engineering, furnishing, installation, cable/conduit and terminations, and mounting materials and supports, as applicable.

C. The responsibilities indicated in Attachment 1 are provided for clearly delineating the scope of work between the Equipment Procurement Contract and the subsequent Construction Contract.

D. Unless otherwise noted, equipment marked as "Provided By Vendor" is included in the scope of this Equipment Procurement Project, while installation and site-related activities identified as "Installed By the Contractor" shall be performed under the Construction Contract.

E. The Major Equipment List is intended to supplement the requirements of the Contract Documents and shall not be construed to relieve the Vendor or Construction Contractor of their respective responsibilities as defined elsewhere in the Specifications

APPENDIX 1 - SLUDGE DEWATERING IMPROVEMENTS MAJOR EQUIPMENT LIST

verdantas

Gate #1 Sludge Dewatering Improvement - Major Equipment List

Date: 4/14/2026

Note:

Item	Qty	Description	Status	Engineering By	Provided By	Installed By	Cable /Conduit & Terminations By	All Mounting Material, Hardware and Supports By	Notes
1	1	Screw Press Complete Skid including all drums, motors, mixers, conveyor, and instrumentation	New	Vendor	Vendor	Site Contractor	Site Contractor	Site Contractor	Screw Press (On skid) instrumentation wiring to (On skid) Local Control Panel by Vendor
2	1	Screw Press Local Control Panel (On skid)	New	Vendor	Vendor	Vendor	Vendor	Vendor	
3	1	Screw Press Main Control Panel (Off Skid)	New	Vendor	Vendor	Site Contractor	Site Contractor	Site Contractor	Panel shall be installed in 2nd floor electrical room Screw Press (Off-Skid) Main Control Panel Power, Control and Network wiring to (On skid Local Control panel) by Site contractor
4	1	Sludge Inlet Flow Meter (In Field)	New	Vendor	Vendor	Site Contractor	Site Contractor	Site Contractor	Wired to Screw Press Main control panel by Site contractor
5	2	Polymer Blending Skid (Each with local control panel)	New	Vendor	Vendor	Site Contractor	Site Contractor	Site Contractor	Wired to Screw Press Main control panel by Site contractor
6	2	Sludge Pump ABB 15HP VFD Local Control Panel	Existing Reuse	N/A	Existing	Existing	Site Contractor	Site Contractor	Existing Sludge Pumps P11 & P12 Local Control Panels shall be reused for new sludge pumps
7	2	Sludge Pump Smart Box (Pressure interlock for VFD)	Existing Replace	N/A	Existing	Site Contractor	Site Contractor	Site Contractor	The Existing Smart Boxes shall be replace with a new pressure monitor system to prevent the pumps from running dry or over pressure
8	2	Sludge Pump Pressure Monitor System (Pressure interlock for VFD)	New	Vendor	Vendor	Site Contractor	Site Contractor	Site Contractor	New pressure monitor system to prevent the pumps from running dry or over pressure
9	2	Sludge Pumps P11 & P12	New	Vendor	Vendor	Site Contractor	Site Contractor	Site Contractor	Replacement for existing Sludge pumps
10	2	Sludge Pumps P11 & P12 Field Disconnects	New	Site Contractor	Site Contractor	Site Contractor	Site Contractor	Site Contractor	Furnish and install new field disconnects per NEC. Wire feedback for disconnect AUX to VFD as a interlock

END OF SECTION 011100

SECTION 013323 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section defines the requirements for preparation, submission, review, and resubmission of shop drawings, product data, and related submittals required to demonstrate compliance with the Contract Documents.

B. All submittals shall be prepared by the Manufacturer and reviewed and approved by the Vendor prior to submission to the Engineer. Vendor approval constitutes confirmation of coordination, completeness, and conformance with the Contract Documents.

C. Requirements of Section 013323 govern the preparation, review, and approval of all submittals associated with the equipment furnished under Section 011100.

1.2 GENERAL REQUIREMENTS

A. The Manufacturer shall submit detailed drawings, catalog data, specifications, and material certifications for all equipment and materials specified or required for proper completion of the Work.

B. The purpose of submittals is to demonstrate compliance with the design concept of the Project and to provide sufficient detail for fabrication, assembly, installation, coordination, and quality verification.

C. Shop drawings shall be clear, complete, and legible to permit the Engineer and Owner to verify conformance with Contract Documents and to confirm that the equipment delivered corresponds to the reviewed submittals

1.3 ENGINEER REVIEW

A. Review of submittals by the Engineer is for general conformance with the design concept and Contract Documents only. Such review does not relieve the Manufacturer or Vendor of responsibility for accuracy, completeness, coordination, proper fit, functioning, performance, or compliance with all Contract requirements. Engineer review shall not be construed as approval of deviations unless explicitly identified and accepted in writing.

B. The engineer review does not extend to means, methods, techniques, sequencing, procedures of construction, or safety precautions.

C. Review by the Engineer shall not relieve the Manufacturer of responsibility for:

1. Accuracy and completeness of submittals
2. Proper fit, functioning, and performance
3. Coordination of the Work
4. Compliance with all Contract requirements

D. Engineer review shall not be construed as approval of deviations from the Contract Documents unless such deviations are specifically identified in writing and expressly accepted.

E. The Manufacturer shall reimburse the Owner for all engineering and administrative costs incurred in evaluating “or Equal” requests, regardless of approval outcome.

1.4 SUBMITTAL SCHEDULING

A. Shop Drawings shall be submitted in proper sequence and sufficiently in advance regarding the time required for checking, transmittal, and resubmittal without delay in the Work.

B. Failure to submit required submittals in a timely manner shall not constitute grounds for time extension.

C. Allow a minimum of twenty-one (21) calendar days for Engineer review following receipt of a complete submittal.

D. No Work requiring shop drawing shall proceed until submittals have been reviewed by the Engineer.

E. Accepted and reviewed Shop Drawings shall not be construed as approval of changes from Contract plan and specification requirements.

F. The Engineer will review the first and second complete Shop Drawing submittals at no cost to the Owner. Review of a third or subsequent resubmittal required due to incomplete, incorrect, or non-conforming information provided by the Manufacturer or Vendor shall be performed at the Manufacturer’s expense.

G. A detailed field performance testing plan shall be submitted for review prior to shipment, including duration, sampling methods, acceptance criteria, and corrective action procedures.

1.5 SUBMITTAL PROCEDURE FOR THE EQUIPMENT PROCUREMENT CONTRACT

A. All submittals shall be transmitted to the Engineer by the Manufacturer responsible for the complete packaged equipment system.

B. The Vendor of the packaged sludge dewatering equipment shall review and approve all Shop Drawings prior to submission. Vendor’s approval shall constitute a representation to Owner and Engineer that Vendor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Vendor has reviewed or coordinated each Shop Drawing with the requirements of the work and the Contract Documents.

C. Submittal Preparation: Mark each submittal with a permanent label or page for identification. Provide the following information on the label for proper processing and recording of action taken:

1. Project name
2. Contract name
3. Location
4. Engineer's name and address
5. Vendor of the complete packaged system
6. Manufacturer name and address of individual equipment.
7. Specification Section number and title
8. Drawing numbers and detail references
9. Submittal sequence or log number
10. Space for Vendor approval and Engineer action stamp.

D. Each submittal shall include the following statement signed by the Manufacturer:

By this submittal, I hereby certify that all field constraints, construction criteria, materials, dimensions, catalog numbers, and related data have been determined and verified, and that each item has been checked and coordinated with all applicable approved shop drawings and Contract requirements.

_____ _____

Signature Date

_____

Company

E. Shop Drawings shall be submitted in electronic format for review. After approval of the submitted shop drawings by the Engineer, not less than three (3) copies shall be submitted to the Engineer at the address specified in the Equipment Procurement Contract Conference.

1.6 DEVIATIONS

A. At the time of each submission, THE Vendor shall clearly identify in writing any deviations from the Contract Documents.

B. Failure to identify deviations shall constitute a representation that the submittal fully complies with the Contract Documents and shall not be grounds for subsequent claims.

1.7 ENGINEER ACTION

A. The Engineer will review each properly submitted submittal and stamp it to indicate action taken.

B. Review of individual components does not constitute review of assemblies; complete systems shall be submitted as coordinated packages.

C. Compliance with Contract requirements remains the Manufacturer's responsibility regardless of review status.

1.8 REVIEW PROCEDURE

A. Drawings shall be clean, legible, and shall show necessary working dimensions, arrangement, material finish, erection data, and information needed to define what is to be furnished and to establish its suitability for the intended use. Specifications may be required for equipment or materials to establish any characteristics of performance where such are pertinent. Suitable catalog data sheets showing all options and marked with complete model numbers may, in certain instances, be sufficient to define the articles which it is proposed to furnish.

B. Action Stamp: The Engineer will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:

1. Reviewed – No Exceptions Taken: Submittal is in general compliance; no resubmittal required.
2. Reviewed – Approved as Note: Minor comments noted; resubmittal not required.
3. Revise and Resubmit: Submittal is incomplete or inadequate; resubmittal required.
4. Rejected: Submittal does not comply with Contract Documents; new submission required.

C. Submittals requiring a Change Order will not be returned until the Change Order is approved or otherwise directed by the Owner.

END OF SECTION 013323

SECTION 013325 - WARRANTY

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section provides procedures and requirements for warranting the Work. The enumerated warranties herein are in no way intended to abrogate any implied warranties associated with goods supplied under this Contract.

1.2 SUMMARY

A. Work Included:

1. Preparation of Warranties for submittals.
2. Requirements for the content and submittal of Warranties.

1.3 RELATED DOCUMENTS

A. This Section includes minimum requirements for the warranty of the equipment. See also all equipment specification sections for additional requirements.

B. Section 013323, Shop Drawings, Product Data, and Samples.

1.4 SUBMITTALS

A. As a part of the submittals for each item of equipment or a group of equipment items, include a DRAFT Warranty containing all of the language and terms specified.

B. Following completion of the terms for establishment of the Warranty specified, prepare Warranties for submittal per section 013323 and the following:

1. Warranties for projects or portions of the work, established on a particular date as specified herein, may be submitted as a group.
2. Label each submittal with the title “WARRANTY”, the project name, the effective date, the Contractor’s name, address, and telephone number.
3. A Table of Contents shall be included, identifying each item with a number and title of specification section and the name of the product or Work item.
4. Separate Warranty for each specification section item with index tab sheets. Label tables to conform to the Table of Contents.

C. The Warranty shall contain, as applicable:

1. Effective starting date and end date of the Warranty period.
2. Statement of the terms and conditions of the Warranty, if any.

3. Statement that all Operating and Maintenance information has been provided and approved.

4. Statement that all training and training materials have been provided and approved.

5. Statement that the equipment or system commissioning is complete and has been reviewed and accepted by the manufacturer in accordance with provisions of the individual Sections in Divisions 1 through 46 of the Project Manual, as applicable.

6. Certifications by the Contractor and/or Manufacturer that the statements noted above are true and correct. This certification shall be signed by a person authorized to sign documents on behalf of the Contractor.

D. Special warranties, as required by individual Sections in Divisions 1 through 46 of the Project Manual, shall be submitted in accordance with the requirements of this Section.

PART 2 - PRODUCTS

2.1 WARRANTIES

A. Term or Period

1. The Warranty shall guarantee that the equipment is free from defects in materials and workmanship for a period of twelve (12) months from the dated of Substantial Completion and successful startup, or eighteen (18) months from the date of deliver to the Contractor, whichever occurs first, unless a longer warranty period is specified in the applicable individual Sections of Divisions 1 through 46 of the Project Manual.

2. The delivery of the packaged equipment shall occur under a separate Construction Contract following selection of the General Contractor, but not earlier than October 2026.

B. Contractor's Responsibilities

1. During the Warranty period, the Manufacturer is responsible for repair or replacement of all failures and defects, exclusive of ordinary and routine maintenance and failures directly traceable to the lack thereof. This requirement shall be thoroughly explained by the Contractor to all prospective equipment suppliers. Repairs or replacement shall be performed in accordance with the Conditions.

PART 3 - EXECUTION

3.1 EXECUTION OF WARRANTY

A. The approved DRAFT Warranty will be executed and placed in effect as the FINAL Warranty on the date of Final Completion of the Work for the specific equipment item or group named in the Warranty.

END OF SECTION 013325

SECTION 013326 – PRODUCT TESTING AND CERTIFYING

PART 1 - GENERAL

1.1 QUALITY OF MATERIALS

A. Where the specifications require mill or factory tests, the Manufacturer shall furnish duplicate copies of certified manufacturer's test reports demonstrating compliance with the Contract requirements, including applicable quality and performance data.

B. Mill, shop, or witness tests shall be subject to observation by the Engineer's authorized representative; however, such observation shall not relieve the Manufacturer of the obligations to furnish the required certified test reports.

C. The Manufacturer shall notify the Engineer in writing at least two (2) weeks in advance of scheduled testing to allow arrangements for witnessing the test to be made. Any waiver of test witnessing shall be made in writing by the Engineer only.

D. All reasonable costs associated with travel, lodging, meals, and transportation necessary for the Engineer's representative and the Owner's representative to attend witness tests shall be paid by the Owner.

E. Unless otherwise specified, all materials, equipment, and articles shall be erected, installed, or connected, used, cleaned, and conditioned in accordance with the printed instructions and directions of the manufacturer.

F. The installation shall be so made that its several components will function together as a workable system. It shall be complete with all accessories necessary for its operation and shall be left with all equipment properly adjusted and in working order.

G. The work shall be executed in conformity with the best practice and to contribute to efficiency of operation, minimum maintenance, accessibility, and sightliness. It shall also be executed so that the installation will conform and accommodate itself to the building structure, its equipment, and usage.

H. Whenever in the contract documents a particular brand, make of material, device, or equipment is shown or specified, such brand, make of material, device, or equipment is to be regarded merely as a standard, and such trade name shall be followed by "or equal".

1.2 QUALITY ASSURANCE

A. The equipment and materials to be furnished under this Contract shall be the products of well-established and reliable firms that have had ample experience for at least five (5) years in the manufacture of equipment or materials similar in design and of equal quality to that specified. If required, the manufacturer shall submit a list of installations of similar equipment that have been in successful operation for at least five (5) years.

1.3 EXPERIENCE CLAUSE REQUIREMENT AND PERFORMANCE BONDS FOR MANUFACTURER

A. For every piece of equipment furnished under this Contract, the manufacturer will be required to have a minimum of five (5) years of experience in providing this specific type of equipment. In lieu of this experience requirement, the manufacturer will be required to provide performance bond(s) for the faithful performance of the equipment and guarantee payment in a sum of not less than one hundred and fifty percent (150%) of the total equipment price for the completed work for that item. In the absence of verifiable experience, the manufacturer will be required to provide the performance bond(s) for the same number of years that the manufacturer was found lacking in experience from the specified five (5) year period. The performance bond(s) shall be from an approved surety company to the satisfaction of the Owner's Law Director.

B. Agents of bonding companies which write bonds for the performance and payment of the contract shall furnish the power of attorney bearing the seal of the company, evidencing such agent's authority to execute the particular type of bond to be furnished, and evidencing also the right of the surety company to do business in the State of Virginia. A copy of this proof shall be attached to each copy of the contract.

C. The bond shall be purchased through a surety company with a local agent upon whom service of process can be made.

D. In the event of failure of surety or co-surety, the manufacturer shall immediately furnish a new bond, as required herein. The manufacturer's bond will not be released until all provisions of the contract have been fulfilled.

E. The surety used for the bid bond and performance bond shall be listed in the latest U.S. Treasury Circular 570, and the Penal Sums shall be within the maximum specified for such company in said Circular 570.

END OF SECTION 013326

SECTION 014223 - INDUSTRY STANDARDS

PART 1 - GENERAL

1.1 ABBREVIATIONS

A. Abbreviations, as used, designate the following:

ACI	-	American Concrete Institute
AIEE	-	American Institute of Electrical Engineers
AISC	-	American Institute of Steel Construction
ANSI	-	American National Standards Institute
ASTM	-	American Society of Testing and Materials
AWWA	-	American Water Works Association
CMS	-	Construction and Material Specifications
NEMA	-	National Electrical Manufacturers Association
W. Va Code	-	West Virginia Code Chapters
UL	-	Underwriters Laboratories, Inc.

1.2 REFERENCE TO OTHER SPECIFICATIONS

A. Where reference is made to specifications such as ASTM, AWWA, or ANSI, the latest edition shall be used, unless otherwise noted on the plans or in the specifications.

1.3 CODES AND STANDARDS

A. All work provided for by these specifications must be installed according to the provisions of the State and local building codes, subject to inspection and acceptance by the State and local inspectors.

END OF SECTION 014223

SECTION 016600 - PRODUCT STORAGE AND HANDLING REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section includes requirements for packing, delivery, storage, handling, protection, inspection, and preservation of equipment and materials furnished under the Equipment Procurement Contract.

PART 2 - DELIVERY AND STORAGE OF MATERIALS

2.1 DELIVERY

A. The Vendor shall be responsible for proper packing, protection, and storage of all furnished equipment at the Vendor's designated storage facility contingent upon the selection of the General Contractor (aka Contractor) not earlier than October 2026, or until otherwise directed by the Owner. Storage shall be in accordance with the Manufacturer's written equipment preservation requirements.

B. The Vendor shall coordinate shipment and transfer dates with the Contractor at least thirty (30) calendar days in advance. Risk of loss, damage, or delay shall remain with the Vendor until the equipment has been transferred and accepted as specified herein

C. At the conclusion of the storage period, the Vendor shall transfer the equipment and all applicable Operation and Maintenance Manuals, preservation records, and installation requirements to the General (Installation) Contractor. Responsibility for handling, storage, and protection shall be transferred at that time.

2.2 INSPECTION AND ACCEPTANCE

A. Upon transfer to the Contractor or designated delivery location, the Contractor shall inspect the equipment within five (5) business days for damage, shortages, or non-conformance with the Contract Documents. Any deficiencies shall be documented and reported in writing to the Vendor and Engineer within the inspection period.

B. Acceptance shall occur upon written confirmation that all identified deficiencies have been corrected or resolved. Title to and risk of loss of the equipment shall be transferred to the Contractor upon acceptance.

C. Following transfer and acceptance, the Contractor shall be responsible for storage, handling, and protection of the equipment in accordance with the Final O&M Manuals and applicable Contract Documents.

PART 3 - EXECUTION

3.1 MAINTENANCE OF STORAGE

A. During the Manufacturer-controlled storage period, the Vendor shall ensure that the Manufacturer preserves and protects the equipment in accordance with approved preservation requirements.

B. The Vendor shall ensure that the Manufacturer maintains a documented inspection and maintenance program for stored equipment to ensure that:

1. Storage facilities continue to provide the required environmental conditions.

2. Environmental conditions (temperature, humidity, cleanliness) are maintained on a continuous basis.

3. Products are protected from adverse environmental effects.

4. Mechanical and electrical equipment requiring long-term storage is serviced in accordance with the Manufacturer's written instructions.

5. Manufacturer's storage and service instructions accompany each item and are clearly identified.

6. Space heaters that are part of electrical equipment are connected and operated continuously until the equipment is placed in service, unless otherwise directed by the Manufacturer.

C. The Contractor shall maintain written inspection and maintenance records and make such records available to the Engineer and Vendor upon request.

D. Records of inspections, environmental conditions, servicing activities, and corrective actions shall be maintained and transferred with the equipment for inclusion in the Final O&M Manual.

E. Prior to release of equipment from storage for installation, a turnover inspection shall be performed by the Contractor to verify that storage and preservation requirements have been met. The results of this inspection shall be documented and included in the Final O&M Manual.

END OF SECTION 016600

SECTION 017823 – MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes requirements for preparation, review, approval, and delivery of Operation and Maintenance (O&M) Manuals for equipment furnished under the Contract.

B. Submittal of O&M Manuals shall be divided into a two-stage process:

1. Preliminary O&M Manuals shall be submitted by the Vendor/ Manufacturer and approved by the Engineer under the Equipment Procurement Contract, prior to equipment shipment. These manuals are not final, as they do not reflect as-installed conditions. These manuals are to support proper storage, handling, installation planning, and coordination with the separately bid Installation Contract.

2. Final O&M Manuals: Complied and submitted by the Contractor under the separate Installation Contract, after equipment installation, startup, and commissioning are complete.

C. The Manufacturer (Supplier or Vendor) shall be responsible for Preliminary O&M Manuals. The Installation Contractor (under a separate contract) shall be responsible for Final O&M Manuals, incorporating the Supplier's documentation and supplementing it with site-specific information developed during installation and commissioning.

D. The Preliminary O&M Manual shall be considered an interface deliverable between the Equipment Procurement Contract and the Installation Contract. The Vendor shall formally transmit the approved Preliminary O&M Manual to the Installation Contractor, and the Installation Contractor shall acknowledge receipt and completeness prior to commencement of installation work.

1.2 DEFINITIONS

A. Preliminary O&M Manual: The initial operation and maintenance documentation prepared by the equipment Supplier and submitted for the Engineer's review and approval prior to authorization of equipment shipment.

1. Preliminary O&M Manuals shall contain the manufacturer's standard operating instructions for the equipment handling and protection during short- and long-term storage and maintenance requirements, lubrication requirements, factory test performance and nameplate data, installation details and requirements, diagrams and illustrations, recommended spare parts lists, and all other essential data available before field installation.

2. Preliminary O&M Manuals are understood to exclude certain site-specific details (such as built configurations, field-verified settings, commissioning records, and field test results) that are not yet available at the time of equipment fabrication and shipment.

3. Preliminary O&M Manuals shall reflect factory-standard information only and shall not include site wiring diagrams, final control settings, or as-built conditions, which are the responsibility of the Installation Contractor.

B. Final O&M Manual: Complete, consolidated documentation reflecting actual installed, tested, started up, and commissioned, prepared by the Installation Contractor.

1. Final O&M Manuals incorporate the approved Preliminary O&M Manual content (updated as necessary) together with all project-specific data, including as-built drawings, final control settings and relay settings, startup and performance test results, field wiring diagrams, warranty certificates, and other information obtained during installation and commissioning.

2. In the event of conflict between the Preliminary O&M Manual and site-specific information developed during installation, the Final O&M Manual shall govern.

1.3 COORDINATION REQUIREMENTS

A. Preliminary O&M Manuals are designated as interface deliverables between the Equipment Procurement Contract and the Installation Contract.

B. The Equipment Supplier shall formally transmit approved Preliminary O&M Manuals to the Installation Contractor. The General Contractor (aka Contractor) shall acknowledge receipt and completeness prior to commencement of installation work.

1.4 SUBMITTAL REQUIREMENTS FOR THE PRELIMINARY O&M MANUALS (EQUIPMENT PROCUREMENT CONTRACT)

A. Submit Preliminary O&M Manuals electronically for Engineer review not less than 30 calendar days prior to the scheduled shipment date.

B. Equipment shall not be released for shipment until Preliminary O&M Manuals have received an acceptable disposition from the Engineer

C. Preliminary O&M Manuals shall include, as applicable:

1. Equipment Handling and Storage Requirements

2. Maintenance requirements for the equipment during the short- and long-term storage.

3. Descriptive literature, bulletins, or other data covering equipment or system.

4. Complete list of equipment and appurtenances included with the system, complete with manufacturer and model number.

5. Functional description of each principal component of the system.

6. Installation instructions.

7. General arrangement and assembly drawings

8. Utility requirements

9. Materials of construction

10. Factory performance test data
11. Performance guarantee
12. Spare parts list
13. Lubrication requirements
14. Procedure for starting, proper adjustment, and test procedures
15. Shutdown instructions.
16. Emergency operating instructions and emergency shutdown instructions
17. Schematic wiring diagrams
18. Schematic piping diagrams
19. Instrumentation data
20. Drive data
21. Control data
22. Maintenance instructions, including troubleshooting guidelines and preventative maintenance instructions, with a task schedule
23. Required tools and equipment for operation and maintenance
24. Safety Considerations for O&M procedure

D. All material shall be specific to the function that the equipment serves in the facility. If the manufacturer's literature covers more than one product type or includes information not relevant to this project, the applicable information shall be clearly indicated. Only files and documentation specific to the equipment furnished under this Contract shall be included.

E. Preliminary O&M Manuals shall be submitted electronically for review by the Engineer.

F. This information will be accepted only if properly identified and only after it has been revised, where necessary, to conform to previous transmittals of the same material that have been "Approved As Noted" by the Engineer.

G. Upon approval, one (1) hard copy shall be provided to the Owner together with the final electronic version. Submittals shall be on 8-1/2" x 11” paper or folded to that size.

H. Failure to submit acceptable Preliminary O&M Manuals shall constitute a nonconformance and may result in withheld payment or delayed shipment at no additional cost to the Owner

1.5 SUBMITTAL REQUIREMENTS FOR FINAL O&M MANUALS (EQUIPMENT INSTALLATION CONTRACT)

A. Submit Final O&M Manuals electronically not later than 60 calendar days after successful completion of commissioning

B. It will be the responsibility of the Installation Contractor to furnish the Final O&M Manuals, which shall include, at a minimum, site-specific details, as-built configurations, including the field-verified settings, performance test reports, commissioning records, and field test results.

C. This manual shall either contain or make reference to all information that has been issued during the construction and start-up periods, as well as information necessary for the proper operation and maintenance of equipment.

D. Final O&M Manuals shall include documentation of storage duration, storage conditions, inspections, servicing activities, and any deviations from manufacturer-recommended storage requirements occurring prior to installation.

E. Final O&M Manuals shall incorporate and update Preliminary O&M Manual content and include:

1. As-built drawings
2. Final wiring and piping diagrams
3. Actual control, relay, and calibration settings
4. Startup and performance test reports
5. Warranty documentation
6. Maintenance procedures applicable to in-service operation.
7. Documentation of storage duration, conditions, inspections, and servicing activities prior to installation.

F. Acceptance of Final O&M Manuals is a condition precedent to Final Completion and final payment.

G. Final O&M Manuals shall be submitted electronically for review by the Engineer.

H. This information will be accepted only if properly identified and only after it has been revised, where necessary, to conform to previous transmittals of the same material that have been "Approved As Noted" by the Engineer.

I. Upon approval, one (1) hard copy shall be provided to the Owner together with the final electronic version. Submittals shall be on 8-1/2" X 11" size paper or folded to that size.

END OF SECTION 017823

SECTION 330900 – PLC & HMI

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. This Section covers the general requirements for furnishing, installing, programming, adjusting, testing, documenting, and commissioning of complete and operational PLC and HMI based control systems. The control system includes (1) one PLC and HMI control system, communications, control devices, motor control, instrumentation, and equipment mounted HMI panel for complete control and monitoring of the screw press system. Control of all components of the dewatering system, including the ability to set times, operation, and operating speeds or capacities for the sludge dewatering press feed pump, discharge sludge cake conveyors, dewatering drums, mixers, polymer blending and feed system, and wash-down sprays. The control system shall be integrated into the Owner's SCADA system.

C. This Section applies to the following control systems and panels:

1. Screw Press Main Control Panel (PLC, VFD & HMI)
2. Screw Press Equipment mounted Operator Panel (HMI)

D. Related Section:

1. Section 467331 – Dewatering Equipment
2. Section 463333 – Polymer Systems
3. Section 461211 – Shaftless Conveyor
4. Section 432110 – Progressive Cavity Pumps
5. Section 26 00 01 – Electrical Systems (Construction Contract)
6. Section 33 09 01 – Instrumentation for Control Systems (Construction Contract)

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only:

1. 47 CFR 15 Radio Frequency Devices
2. IEEE C62.41 Surge Voltages in Low-Voltage AC Power Circuits

B. National Electrical Manufacturers Association (NEMA)

1. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum)
2. NEMA AB 1 Molded Case Circuit Breakers and Molded Case Switches

3. NEMA ICS 1 Industrial Controls and Systems
4. NEMA ICS 2 Industrial Control Devices, Controllers and Assemblies
5. NEMA ICS 4 Industrial Control and Systems: Terminal Blocks
6. NEMA ICS 6 Enclosures for Industrial Control and Systems
7. NEMA ST1 Standard for specialty transformers

C. National Fire Protection Association (NFPA)

1. NFPA 70 National Electrical Code
2. NFPA 780 Installation of Lightning Protection Systems
3. NFPA 810 Radio and Television Equipment

D. Underwriters Laboratories (UL)

1. UL 50 Enclosures for Electrical Equipment
2. UL 83 Thermoplastic-Insulated Wires and Cables
3. UL 94 Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
4. UL 444 Standards for Communication Cables
5. UL 467 Grounding and Bonding Equipment
6. UL 486A Wire Connectors and Soldering Lugs for Use with Copper Conductors
7. UL 489 Molded-Case Circuit Breakers and Circuit-Breaker Enclosures
8. UL 508 The Standard for Industrial Control Equipment
9. UL 508A Outline of Investigation for Industrial Control Panels
10. UL 698 Industrial Control Equipment for Use in Hazardous (Classified) Locations
11. UL 886 Outlet Boxes and Fittings for Use in Hazardous Locations
12. UL 913 Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division I Hazardous Locations
13. UL 1063 Machine Tool Wires and Cables
14. UL 1092 Process Control Equipment
15. UL 1203 Explosion Proof and Dust Ignition Proof Electrical Equipment for Use in Hazardous Locations
16. UL 1449 Standard for Transient Voltage Surge Suppression
17. UL 1604 Electrical Equipment for Use in Hazardous Locations, Class I and Class II, Division 2 and Class III, Divisions 1 and 2
18. UL 1778 Uninterruptible Power Supply Equipment
19. UL 2225 Standard for Metal-Clad Cables and Cable Sealing Fittings for Use in Hazardous Locations

20. UL 2279 Electrical Equipment for Use in Class I, Zone 0, 1, and 2 Hazardous Locations

1.3 DEFINITIONS OF TERMS

A. UL 50 Enclosures for Electrical Equipment

B. UL 83 Thermoplastic-Insulated Wires and Cables

C. UL 94 Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

D. UL 444 Standards for Communication Cables

E. UL 467 Grounding and Bonding Equipment

F. UL 486A Wire Connectors and Soldering Lugs for Use with Copper Conductors

G. UL 489 Molded-Case Circuit Breakers and Circuit-Breaker Enclosures

H. UL 508 The Standard for Industrial Control Equipment

I. UL 508A Outline of Investigation for Industrial Control Panels

J. UL 698 Industrial Control Equipment for Use in Hazardous (Classified) Locations

K. UL 886 Outlet Boxes and Fittings for Use in Hazardous Locations

L. UL 913 Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division I Hazardous Locations

M. UL 1063 Machine Tool Wires and Cables

N. UL 1092 Process Control Equipment

O. UL 1203 Explosion Proof and Dust Ignition Proof Electrical Equipment for Use in Hazardous Locations

P. UL 1449 Standard for Transient Voltage Surge Suppression

Q. UL 1604 Electrical Equipment for Use in Hazardous Locations, Class I and Class II, Division 2 and Class III, Divisions 1 and 2

R. UL 1778 Uninterruptible Power Supply Equipment

S. UL 2225 Standard for Metal-Clad Cables and Cable Sealing Fittings for Use in Hazardous Locations

T. UL 2279 Electrical Equipment for Use in Class I, Zone 0, 1, and 2 Hazardous Locations

1.4 SPECIAL REQUIREMENTS

A. All Scope of Work shall be provided under the supervision of a single Contractor

B. The Contractor shall be specialized in the design, assembly, programming, testing, installation, and service of PLC control systems for at least the last (8) eight years. Contractor shall provide supporting documentation with their bid demonstrating this requirement.

C. The Contractor shall employ technical and professional staff with documented experience in the design, assembly, programming, testing, installation, operation, troubleshooting, and service of PLC control systems. Contractor shall provide supporting documentation on their staff with their bid demonstrating this requirement.

D. The Contractor shall be experienced with the programming and commissioning of the respective PLC, HMI, and Motor Control systems. Contractor shall provide supporting documentation with their bid demonstrating this requirement.

E. The Contractor shall become familiar with all details of the work and verify any required dimensions and distances. Contractor shall understand and document, as needed, any existing power panels, field wiring, instrumentation, and field devices. If any conflicts occur necessitating departures from the drawings, details of and reasons for departures shall be submitted and approved prior to implementing any change.

1.5 STANDARD PRODUCTS

A. Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least (5) years prior to bid opening.

1.6 MATERIALS AND EQUIPMENT

A. The label or listing of the Underwriters Laboratories, Inc., shall be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this label or listing, a statement from a nationally recognized, adequately equipped testing agency indicating that the items have been tested in accordance with required procedures and that the materials and equipment comply with all contract requirements will be accepted. However, materials and equipment installed in hazardous locations must bear the UL label unless the data submitted from another testing agency is specifically approved in writing by the Owner. Materials and equipment shall be approved based on the manufacturer's published data. For other than equipment and materials specified to conform to UL publications, a manufacturer's statement indicating complete compliance with the applicable Federal Specification, or standard of the American Society for Testing and Materials, National Electrical Manufacturers Association, or another commercial standard, is acceptable.

1.7 RESPONSIBILITIES

A. The Contractor shall be fully and completely responsible for all work performed and all materials installed under the contract. All contracts between the Contractor and subcontractor(s) shall conform to and meet all requirements specified in the contract documents.

B. The Contractor shall be responsible for, but not limited to:

1. Contractor shall design respective Control Panel drawings in AutoCAD, including back panel layout, front door layout, Bill of Materials, power distribution and grounding, motor control, PLC input and output card drawings, network/system architecture.
2. Contractor shall furnish, assemble, test, and install the control system in accordance with approved Submittals, respective design drawings, specifications, and testing requirements.
3. Contractor shall create and test all custom PLC, HMI, and communications user programs for the control system.
4. Contractor shall provide Submittals as outlined.
5. Contractor shall coordinate and execute the FAT at their facility.
6. Contractor shall ensure that network communication is online and fully functioning with the existing Owner’s network and Owner’s SCADA as part of system commissioning.
7. Contractor shall coordinate and execute the SAT onsite.
8. Contractor shall redline control system design drawings with any changes made during construction, FAT, SAT, and operational testing for updating and delivery of final as-built drawings.
9. Contractor shall provide Spare Parts as outlined.
10. Contractor to provide all electrical permits and inspections as required by the State, County, and City.
11. Contractor shall provide (1) one day of onsite system training for the Owner. Training shall be on regular business days from 8 am to 3:00 pm.

1.8 SUBMITTALS

A. Shop Drawings

1. Contractor shall submit manufacturers' data sheets for Owner review and consideration, and any material, part, or equipment substitutions/modifications requests prior to making a change.
2. Contractor shall submit for Owner review and consideration any material, part, or equipment substitutions/modifications requests prior to making a change.

B. Submittals

1. Contractor shall prepare a complete shop drawing submittal of all (specified or substituted) components, devices, instruments, and equipment, including fully detailed shop drawings, catalog cuts, wiring connections, and such other documentation as may be required to fully describe the equipment and to demonstrate its conformity to these plans and specifications. Catalog information shall be submitted for all components and equipment required for the project.

2. All submittals shall be complete, organized, and indexed. Partial submittals will not be accepted. Submit an electronic copy in PDF.

3. Owner review and approval are required on all shop drawings.

C. HMI Screen Submittals

1. The Contractor shall provide a PDF of all HMI screens utilized in the respective control panel. HMI screen submittal is required for review and approval prior to FAT execution. The screen shall represent the Contractor's final checked version and represent all the screens for the respective control panel.

D. Control Panel Drawing Submittals

1. Following approval of the shop drawing submittals, the Contractor shall provide a complete set of each respective Control Panel set of drawings. Submit an electronic copy in PDF.

E. Data Map to Owner's SCADA Submittal

1. The Contractor shall provide a list in Excel, including tag name, description, register, and units. Indicate if it's a Read or Written value/bit. Submit an electronic copy in PDF.

F. FAT Test Plan

1. Contractor shall submit an electronic copy in pdf of the FAT plan, descriptions and test execution spreadsheets that will be executed.

G. SAT Test Plan

1. Contractor shall submit an electronic copy in PDF of the SAT plan, description, and test execution spreadsheets that will be executed.

1.9 OPERATION AND MAINTENANCE MANUALS

A. Provide Operation and Maintenance (O&M) data for the completed control system. Provide (2) two copies of the O&M manual in a three-ring binder and in PDF electronic format. The O&M manual shall include:

1. All system equipment, components, and device product cutsheets with actual part number and options highlighted.

2. By Control System Panel - control panel functions and indicator descriptions.

3. By Control System Panel - operations and procedures.
4. By Control System Panel - HMI color screen printouts of all screens with a function description of menus, operator control, and input/output data.
5. Troubleshooting section for control procedures
6. Steps to restarting the PLC system from a cold start, such as utility power failure, UPS failure/battery drain.

1.10 SPARE PARTS

A. Spare parts shall be furnished as specified below. Provide a Spare Parts line item cost. All spare parts shall be the same make, model, # and options as the respective approved part in the submittals. Spare parts shall be furnished new in OEM packaging.
1. PLC CPU (Qty. 1 of each type used) with program preloaded on a flash card
2. PLC Output Card (Qty. 1 of each type used)
3. PLC Input Card (Qty. 1 of each type used)
4. PLC Analog Input Card (Qty. 1 of each type used)
5. PLC Analog Output Card (Qty. 1 of each type used)
6. PLC Network or COMM Card (Qty. 1 of each type used)
7. Control Panel UPS (Qty. 1 of each type used)
8. 24 VDC Power Supply (Qty. 1 of each type used)
9. VFD (Qty. 1 of each type/ size used)
10. HMI (Qty. 1 of each type used)
11. Ethernet Switch (Qty. 1 of each type used)
12. Electronic components with long lead time / special order (Qty. 1 of each type used)
13. Extra Fuses (Qty. 10 of each type)
14. Field mounted devices that may experience higher wear or severe duty (Qty. 1 of each type used).

PART 2 - PRODUCTS

2.1 GENERAL

A. Material shall be new, free from defects, and of the quality specified. All equipment and materials utilized in the system shall be the products of manufacturers with a minimum of (8) eight years of experience in the manufacture of similar equipment. Similar items in the system shall be the products of the same manufacturer. All equipment shall be of industrial grade and shall be specifically intended for control, monitoring and operation of motor-driven pumps and equipment. All equipment shall be of modular design to facilitate interchangeability of parts and to assure ease of servicing.

2.2 MAJOR EQUIPMENT LIST

A. Provide all equipment and devices shown on the drawings and specified herein, including but not limited to, the following major Control System equipment:

1. PLC & HMI Control Panels
2. All required screw press process system instrumentation and analytical equipment

2.3 PLC CONTROL PANELS

A. Similar items in the system shall be products from the same Manufacturer.

B. Material shall be new, free from defects, and of the quality specified. All equipment shall be of industrial grade and of standard construction, shall be capable of long, reliable, trouble-free service, and shall be specifically intended for control and monitoring industrial equipment.

1. Control Panel Identification Nameplates
   a. Nameplates shall be furnished for all door-mounted devices. Nameplates shall be duralith or micarta with black letters on a white background. Letters shall be 3/16" high with seven (7) letters per inch, except where indicated otherwise. Engraving shall be done with a blunt tool to provide clear, wide lines. Refer to the design drawings for the control panel front door nameplate schedule.
   b. All components mounted on the interior removable panel shall have identification adjacent to each device, using the same material as the paragraph above, except black letters on a yellow background. The nameplate shall identify the device and schematic device number. The nameplates shall be located to provide an unobstructed view of the nameplate after wiring is complete. All identification nameplates shall have chamfered edges and fastened with stainless steel round head sheet metal screws.
2. Control Panel Enclosures
   a. The enclosures shall be a UL-listed enclosure constructed to NEMA 4X stainless steel specifications. All doors shall have a locking hasp or a key lock handle. Provide two keys per lock. The enclosure back panel shall include a 20% additional capacity for future components. A removable white painted steel inner panel shall be provided for the mounting of equipment devices. A print holder shall be provided inside the door. Removable lifting means shall be provided to facilitate handling of all panels weighing over 200 pounds or exceeding 10 cubic feet in volume.
   b. VCP: The enclosure shall be floor-standing. Provide the enclosure manufacturer's stand kit of the same material where the enclosure does not come with integral feet.
   c. VCP: Contractor shall determine enclosure height, width, and depth based on back-panel and front door-mounted devices.
   d. VCP: Contractor shall verify available wall space for the width and height. The enclosure shall not impede or require the removal or modifications of existing systems, structures, equipment, and utilities.

e. VCP: Contractor shall verify available floor/panel pad space for the width and depth. The enclosure footprint shall not impede or require the removal or modifications of existing systems, structures, equipment, and utilities.
f. VLCP: The enclosure shall be mounted to the contractor's equipment and not require wall or floor space.
g. Saginaw or Approved Equivalent

3. Control Wiring
   a. Wire shall be color-coded as follows:
      1) AC Line & Load: Black
      2) AC Control: Red
      3) Neutral: White
      4) DC + Power: Blue
      5) DC Control: Blue
      6) DC - Common: White/blue stripe
      7) Mechanical Ground: Green or Green/Yellow Stripe
      8) Control Wiring Powered from Other Sources: Yellow
   b. Conductor size shall be #14 or larger (as required). All control, interface, and power wire terminating in the respective control panel shall be stranded wire type MTW or SIS, heavy wall, except where otherwise indicated. DC control wiring shall be stranded #16 AWG or larger except where otherwise indicated.
   c. All instrumentation and analog shielded cables shall be stranded #18 AWG with a 100% coverage shield and drain wire, 150 volt insulation except where otherwise indicated. Terminate and ground shield and drain wire as indicated on drawings. All wiring shall be copper conductors.

4. Terminal Blocks
   a. Terminal blocks shall be sized to accept wires terminating there on with a minimum of 250Vac rating at 15 amps. Terminal blocks shall be suitable for high-rise DIN rail mounting. The blocks shall have tin-plated copper alloy terminals and a marking surface for circuit identification.
   b. Three-level terminal level blocks shall be used for analog I/O shield terminations.
   c. Two-level common connection terminal blocks shall be used for DC circuit distribution.
   d. Terminal block color shall be as outlined on the design drawings. All terminal blocks shall be from the same manufacturer.

5. Wiring Duct and Cover
   a. The wiring duct and cover shall be constructed of white rigid vinyl (PVC). The wiring duct shall have angled and interlocking lips to permit the duct cover to interlock with the duct. The wiring duct size shall be as indicated on the drawings. Wiring duct and covers shall be from the same manufacturer.

6. High Rise DIN Rail
   a. High-rise mounting rail shall be used for all terminal block mounting. The rail shall be constructed of aluminum with a height of 2 to 3 inches. The rail shall be designed for use with DIN rail terminal blocks.

7. Standard Rail
    a. Standard DIN rail shall be used to mount all DIN mountable devices except terminal blocks. The standard DIN rail shall be constructed of rigid aluminum or zinc-plated steel. The rail shall be designed for use with all rail-mounted panel components.

8. Control Panel Enclosure Fan(s) & Vents
    a. The fans and vents shall have an outer removable stainless-steel cover with a replaceable type filter element. The contractor shall determine fan size (CFM) based on the calculated total heat load of the respective panel components and the highest ambient temperature of the panel location. Provide one spare filter element per unit.
    b. Fan package shall be from the Enclosure Manufacturer

9. Control Panel Thermostats
    a. The control panel thermostat shall be a self-contained unit designed for use in control panel enclosures and DIN rail mounting. It shall have a minimum of one normally open contact rated for 120Vac at 1A inductive load. It shall have a minimum set-point adjustment from 40 degrees F to 90 degrees F. The thermostat shall have screw-type connections.

10. Safety Relay for E-Stop or ESD Circuit
    a. The control relay coil voltages shall be 24Vdc. Dual safety input. Automatic and Manual reset options. Minimum of 3 output contacts rated at AC-15: 1.5 A @ 250 Vac, DC-13: 2 A @ 24Vdc. Cross-fault detection, Safety Category 4 and SIL 3. DIN rail mount.
    b. Allen Bradley Guardmaster or Approved Equivalent

11. Control Relays
    a. The control relay coil voltages shall be 24Vdc. The relays shall be socket-type terminals with a mating socket base. The socket base shall be suitable for DIN rail mounting and have pressure plate screw terminal connections. The relays shall have a minimum of two Form C contacts, rated for a minimum of 8 amps each at 120 VAC. The contacts shall be gold. The relay shall have an ON/OFF indicator. The overall dimensional data will not require adjusting the design drawing layout. All control relays shall be from the same manufacturer.
    b. Allen Bradley or Approved Equivalent

12. Control Panel Receptacle
    a. The control panel receptacle shall be a 120VAC 15 AMP receptacle mounted inside the control panel enclosure and designed for panel mounting.

13. 120 Vac Single-Pole Circuit Breakers
    a. The single-pole breakers shall be a thermal magnetic type rated for 10KA short-circuit interrupt current at 120 Vac. The unit shall be rated for a minimum of 230VAC operating voltage and have a minimum electromechanical life of at least 20,000 cycles. The circuit breaker shall have finger and hand-touch-safe screw-type connections and be designed for DIN rail mounting. Single-pole circuit breakers shall be from the same manufacturer.

14. 24 Vdc Single Pole Circuit Breakers
    a. The single pole breakers shall be a thermal magnetic type rated for 10KA short circuit interrupt current at 250 Vdc. The unit shall be rated for 125 Vdc and have a minimum electromechanical life of at least 20,000 cycles. The circuit breaker shall have finger and hand touch safe screw type connections and designed for DIN rail mounting. Single pole circuit breakers shall be from the same manufacturer.

15. Network Switches
    a. The Ethernet switch shall have the required RJ45 ports plus 4 spare ports supporting a transmission speed of 10/100 Mbps and 2 fiber ports (ST) type. Front-facing diagnostic/status LEDs. The unit is designed for direct DIN rail mounting. The overall dimensional data, including cooling space as required by the manufacturer, will not require adjusting the design drawing layout. Rated for installation with adjacent components on the DIN rail without derating. MTBF greater than 80 years/700,000 hours at 25 Deg C operating. Minimum operating temperature range -10 Deg C to 60 Deg C.
    b. Allen Bradley Stratix or Approved Equivalent

16. 24 Vdc Power Supplies
    a. The 24 Vdc power supplies shall be 120 Vac powered and provide 24 Vdc and be sized in amps to power devices with a minimum of 25% spare current capacity output. The 24 Vdc output shall be adjustable from 24 to 28 Vdc. Maximum DC ripple of 50 mV peak to peak. Designed for direct DIN Rail mount. Rated at full current output up to an enclosure temperature of 40 Deg C. Designed to be installed with no air gap between adjacent DIN rail-mounted devices. Power supply shall have a dry contact output for the power supply OK status. MTBF greater than 80 years/700,000 hours at 25 Deg C operating. Minimum operating temperature range -10 Deg C to 60 Deg C.
    b. Sola or Approved Equivalent

17. Uninterruptible Power Supply
    a. The uninterruptible power supply shall be rated for 120VAC with a 750VA capacity. The unit shall be a self-contained unit with a 3-foot, NEMA 5-15P male plug and a minimum of 2 battery/surge receptacles. The unit shall have an input voltage window from 80VAC to 150VAC for utility operation. The unit shall compensate for utility under-voltage (90VAC to 105VAC) by boosting the output. The unit shall compensate for utility over-voltage (125VAC to 140VAC) by decreasing the output. When running on battery, the unit shall provide 115VAC output with a maximum +/- 8% allowable deviation at 60Hz with a maximum +/- 0.1 Hz deviation. The transfer time shall be a maximum of 6 ms. The unit shall have an online circuit breaker and an internal battery with internal current limiting. The batteries shall be hot-swappable, sealed, maintenance-free lead-acid type. The maximum recharge time shall be 5 hours from a completely discharged state. The unit shall have indicator lights for "online", "on battery", "UPS overloaded", and "replace battery". There shall be an audible alarm for "on battery", "low battery", and "overload". The unit shall have full-time EMI and RFI filtering and surge protection. The UPS shall be located at the bottom of the control panel

enclosure and sized such that it doesn't obstruct or interfere with the view or adjustment of back panel and front door-mounted devices.

b. APC or Approved Equivalent

18. Control Panel Pilot Lights
    a. Pilot lights shall be 24Vdc rated with high-intensity LED cluster lamps. The units shall have the same NEMA rating as the control panel enclosure. The pilot light shall have a minimum diameter of 30mm, NEMA style. The LED cluster and lens shall be of the same color. The LED cluster and lens shall be field removable for future replacement. Where front door-mounted pilot lights are provided, the color of the pilot light shall follow this methodology:
        1) Control Power On – Green
        2) Emergency Stop – Red Mushroom Head, Maintained Operator
        3) Equipment or Device General Fault/Alarm Light – Red
        4) Equipment or Device Running – Green
        5) Open/Running – Green
        6) Close/Stopped – Red
        7) Alarms – Red
    b. Pilot Lights shall be from the same manufacturer and model type as other front door-mounted devices on all control panels.
    c. Allen Bradley or Approved Equivalent

19. Control Panel Pushbuttons
    a. The pushbuttons shall have a minimum of two normally open and two normally closed contacts rated for 7 amps at 120VAC. The contacts shall be field removable for future replacement. The unit shall be rated for a minimum of 1 million cycles. The pushbutton shall be a flush operator. The pushbuttons shall be rated for NEMA 4/4X and a minimum of 30 mm in diameter. Where front door-mounted pushbuttons are provided, the color of the pushbutton shall follow this methodology:
        1) Control Power On – Green
        2) Emergency Stop – Red Mushroom Head, Maintained Operator
        3) General Fault/Alarm Reset – Black
        4) Motor Start – Green
        5) Motor Stop – Red
        6) Equipment or Device Start – Green
        7) Equipment or Device Stop – Red
    b. Pushbuttons shall be from the same manufacturer and model type as other front door-mounted devices on all control panels.
    c. Allen Bradley or Approved Equivalent

20. Control Panel Two/Three Position Selector Switches
    a. Position selector switches shall have a minimum of two normally open and two normally closed contacts rated for 7 amps at 120VAC. The contacts shall be field removable for future replacement. The unit shall be rated for a minimum of 1 million cycles. The unit shall be a two-position maintained operator with the key lock in both positions. The units shall have the same NEMA rating as the control panel enclosure. They shall have a minimum diameter of 30mm, NEMA style. Provide a "no-spin" locking ring washer.

Three-position selector switches are required for all motors, pumps, and motor-operated devices to facilitate HAND OFF AUTO mode control.

b. Selector switches shall be from the same manufacturer and model type as other front door-mounted devices on all control panels.

c. Allen Bradley or Approved Equivalent

21. Motor Starters

a. Motor starters shall be NEMA rated starters. The overload and starter shall be intended to be used together by the manufacturer. The starter shall have an auxiliary N.O. contact for the PLC to monitor the running status of the starter. The motor starter coil shall be 24Vdc unless otherwise specified. The starter contacts shall be rated for a minimum of 1 million cycles at intended current usage for the AC-3 category. IEC type motor starters shall be sized with a 30% additional current load capacity.

b. Allen Bradley or Approved Equivalent

22. Motor Overloads

a. The overload and starter shall be intended to be used together by the manufacturer. The overload shall electrically interlock the starter with an N.C. contact. The overload shall have an auxiliary N.O. contact for the PLC to monitor the overload status of the motor overload and an additional contact to interlock the starter from being energized. The overload shall have an adjustable trip range to allow field setting of the trip.

b. Allen Bradley or Approved Equivalent

23. AC Motor Current Sensing Relay

a. The CT sensing relay shall be a panel-mounted enclosed device with a CT loop to monitor one phase of the motor. The sensing relay shall be self-powered and not require adjustment or calibration. The relay shall be sized according to the respective motor current it will be monitoring. The switch shall close when it detects the required motor current, indicating a run condition. This switch is required for all motors controlled by motor starters. Each respective switch shall be monitored by the PLC digital input.

b. RK Electronics or Approved Equivalent

24. Variable Frequency Drives (VFD)

a. Allen Bradley, ABB, or Approved Equivalent

b. VFD Sizing: The FLA output rating of the VFD shall meet or exceed the actual motor nameplate of the connected load, except for the following specific sizes:

1) 0.5 to 1.0 HP motors – 1 HP rated VFD
2) 1.5 to 2.0 HP motors – 2 HP rated VFD
3) 3.0 HP to 5.0 HP - 5 HP rated VFD

c. VFD Enclosure and Mounting: NEMA 1 rated housing where installed inside a NEMA 12, 13, 3R, 4, or 4X-rated panel enclosure. The VFD shall be designed to be mounted inside a control panel enclosure with a maximum of 2 inches of space required on the top and the bottom for ventilation without output current de-rating. The VFD shall be rated for zero clearance mounting on both sides.

d. VFD Communications: Integral Ethernet/IP and RS485 ports. All of the VFD internal commands and status words shall be accessible without additional interfaces or communication protocols to the PLC CPU.

e. VFD Onboard Inputs and Outputs: The VFD shall have built-in or plug-in modular type cards that provide PLC accessible digital and analog inputs and outputs. Minimum of six (6) programmable 24VDC digital inputs, four (4) 24VDC or relay programmable digital outputs. Minimum of (2) analog inputs scalable for 0-10VDC and 4-20mA with a minimum of 10-bit resolution. Minimum of (1) analog outputs scalable for 0-10VDC and 4-20mA with a minimum of 10-bit resolution.

f. VFD Control:
   1) The VFD has the option of being controlled from PLC software commands over Ethernet or hardwired commands wired into the VFD IO. Control is defined as speed, selectable acceleration times, selectable deceleration times, start, and stop.
   2) A minimum of four (4) accel and decel modes can be programmed in a range of 0 to 600 seconds in 0,1 increments. Stop modes shall include selection of Ramp, Coast, DC-Brake, and Ramp to Stop.

g. VFD Keypad Interface:
   1) All VFDs shall have the same manufacturer keypad interface regardless of horsepower rating. The keypad shall be removable from the VFD with a cable for remote mounting on the front door of the panel enclosure. The keypad interface shall have the same NEMA rating as the panel enclosure. The keypad will have a display and provide a means for an operator to allow program parameter settings and run the VFD in a manual mode (HAND) without the need for PLC control.
   2) The keypad shall provide a means to view historical fault codes and times. All applicable operating values shall be capable of being displayed in engineering (user) units. The display shall be in complete English words (alpha-numeric codes are not acceptable):
      a) Output Frequency
      b) Motor Speed (RPM, %, or Engineering units)
      c) Motor Current
      d) Drive Temperature
      e) DC Bus Voltage
      f) Output Voltage

h. VFD Electrical: The line in voltage tolerance shall be a minimum of -15% and +10%. Power blip ride through shall be at least 100ms. The line in frequency tolerance shall be a minimum of a range of 50Hz to 63Hz. Maximum short circuit rating of 60,000 amps symmetrical. shall operate on a line voltage overload rating of the drive shall be 150% of its normal rated duty current for 60 seconds.

i. VFD Electrical Protection: The overload rating of the drive shall be 150% of its normal rated duty current for 60 seconds and 200% for 3 seconds. The VFD shall have a built-in ground fault trip that detects phase to ground. The VFD shall have a built-in phase-to-phase (short circuit) fault trip.

j. VFD Environmental: Continuous operating temperature from 0 Deg F to 120 Deg F without output current de-rating. Continuous operating at altitudes of 0 to 3300 feet above sea level and up to 95% humidity, non-condensing, without output current de-rating.

25. VFD Line & Load Reactors
    a. The VFD line reactor shall be sized according to the HP rating of the respective connected VFD. They shall be rated for line voltage with finger-safe line and lug terminals. They shall be rated for 3% impedance. They shall be an open type and recommended for mounting and use inside an enclosure.
    b. The requirement for VFD load reactors shall be as specified in the VFD manufacturer's installation requirements based on the length and type of motor cable for the respective motor installation.

26. Main Disconnect
    a. The VFD panel main disconnect shall be a flange-mount type suitable for direct mounting on the enclosure manufacturer's flange mount knockout. The disconnect handle shall be a flexible cable type with all required mounting and cable operator hardware. The disconnect shall be a non-fusible type, complete with the manufacturer's rated line and lug kits. The operator handle shall be all metal with an equal or better NEMA rating than the panel enclosure. Current and voltage rating of the disconnect shall be as required based on the total motor and control panel load.
    b. Square D or Approved Equivalent

27. Main Circuit Breaker
    a. The motor branch circuit breaker shall be rated for the line voltage of the motors and recommended for mounting and use inside an enclosure. The circuit breaker trip rating shall be sized for a minimum of 150% of the respective total connected motor and panel current. The circuit breaker shall have a standard magnetic trip and a minimum short circuit rating of 50kA.

28. Power Distribution Block
    a. Distribution blocks shall be rated for line voltage and recommended for mounting and use inside an enclosure. The block shall be sized for a minimum of 150% of the respective total connected motor and panel current. They shall have a finger safe cover over the line, load lugs, and block.

29. Intrinsically Safe Barriers
    a. Intrinsically safe interfaces shall be used on all field mounted components located in a hazardous location. The intrinsically safe devices shall be selected by the contractor based on the field devices conductor quantity, primary side voltage, and current requirements.

2.4 PLC SYSTEM

A. PLC Hardware

1. All PLC hardware shall be Allen Bradley CompactLogix or an approved equivalent.

2. PLC CPU: Allen Bradley 5380 5069-L320ER Processor.

3. PLC I/O: Provide CompactLogix Digital Input & Output, Analog Input & Output cards as required for the respective number and type of terminations. Include a minimum of 25% spare on each type of card.

4. Provide all required cables and pre-loaded development software and licenses for a complete and operational system.

5. Contractor shall program, test, and commission the HMI in accordance with these specifications.

B. HMI Screens:

1. HMI screens shall be Allen Bradley FactoryView Plus with a 15" color screen or approved equivalent. HMI shall have Ethernet and USB connectivity, NEMA 4X rated, front door mount, 512MB or approved equivalent.

2. Provide all required cables and pre-loaded development software and licenses for a complete and operational system.

3. Contractor shall program, test, and commission the HMI in accordance with these specifications.

C. Programming of PLC and HMI

1. The Contractor shall develop and execute all programming, functional testing and commissioning for the entire control system according to the descriptions in this specification and design drawing features and place the complete system into operation.

2. Adjustments or additional required sequence interlocks, alarming, or minor graphic features added during testing and commissioning shall be included in the bid price.

3. The Contractor shall provide all field technicians to execute the startup and functional checkouts and performance testing of the complete control system.

4. PLC and HMI developed program files shall become the property of the Owner and shall be provided on a USB drive with full access rights.

D. PLC & HMI Programming Software

1. The PLC and HMI programming development software are provided solely by the Contractor for developing the software applications for the project.

PART 3 - EXECUTION

3.1 GENERAL

A. Install materials and equipment in a workman-like manner, utilizing craftsmen skilled in the respective trade. Provide work that has a neat and finished appearance.

B. Conduit penetrations are not permitted through the top of any enclosures or equipment.

3.2 GENERAL

A. Grounding

1. The control panel enclosure, back panel, and front door shall be grounded to the incoming ground bus using #14 green stranded wire. All internal and field ground wiring shall be grounded to the ground terminals. The ground terminals shall be grounded to the incoming ground bus using #14 green stranded wire.

B. VCP Enclosure Mounting

1. The enclosure shall be floor-standing and securely mounted to both the floor and wall/ structure. Floor fasteners and anchors shall be stainless steel.

2. All wall fastening shall utilize galvanized or zinc-coated steel Unistrut, stainless steel fasteners, and stainless steel anchors.

C. VLCP Enclosure Mounting

1. The enclosure shall be mounted on the contractor’s equipment.

2. Enclosure fastening shall utilize galvanized or zinc-coated steel Unistrut, stainless steel fasteners, and stainless steel anchors.

D. Enclosure Cutouts

1. All cutouts on enclosures and doors shall be made with a hydraulic die-type knockout tool. Knockout size for mounting components shall be in accordance with the component manufacturer's installation specifications. Knockouts for pushbuttons, pilot lights, and selector switches shall be 2.75-inch centers.

2. Top penetrations of the enclosures are not permitted.

3. All cutouts shall be free from burrs, rough edges, and damage. Incorrect cutouts compromising the NEMA rating of the enclosure or impairing proper solid mounting of the respective component will require the Contractor to replace the door or enclosure.

E. Wiring Identification

1. All control wires shall be identified at both ends with numbers shown on the design drawings using heat-shrinkable identification sleeves, computer-generated black lettering on white sleeve. Handwritten wire numbering will not be accepted.

F. Nameplate Identification

1. All devices and equipment mounted on the removable back-panel shall have identification adjacent to each device. All nameplates shall be located to provide an unobstructed view of the nameplate after wiring is complete. Do not mount nameplates on wireway covers.

G. Internal Panel Wire Routing

1. A.C. and D.C. wiring shall be kept separate as much as possible. All A.C. and D.C. control wires shall be terminated in terminal blocks. All shielded wire conductors

shall be furnished before terminating with a slip-on crimp-style pin terminal with an insulated grip. If a method of distributing strain on wire bent frequently, such as those connected to devices on doors, is not employed, extra flexible hinge wire shall be used.

H. Terminal Blocks

1. Terminal Block Installation: Terminal blocks shall be sized to accept wires terminating thereon. All terminal blocks shall be identified with the wire number terminating thereon. All terminal blocks shall be of a color outlined in the products section. Terminal blocks shall be mounted on a high-rise mounting rail to permit easy installation and removal of wiring. Terminal blocks shall be provided with 15% spare terminals. Terminal blocks shall be furnished in the cabinet for all external connections. The side of terminals indicated for field connections shall be free of internal wire terminations. Provide end anchors at the end of a terminal section. Provide terminal block jumper bars/strips where common circuits are required on two or more terminal blocks.

2. Terminal Block Layout: Install and layout terminal blocks in common groups. Common groups are 120Vac, Neutral, Ground, 24Vdc, Inputs, Outputs. Input and Output groups shall be installed in addressing order.

I. PLC Input/Outputs and Wiring

1. All PLC digital inputs shall be 24Vdc unless otherwise specified

2. Relay output cards shall be used to control AC voltage devices, systems with a different source of power, and where electrical isolation is required.

3. 24Vdc outputs cards shall be used for 24Vdc devices not exceeding 75 % of the power ratings of the output channel.

4. All PLC digital/analog inputs and outputs shall be terminated. This includes all unused inputs and outputs. All input and output devices connected to the PLC shall be terminated on the appropriate colored terminal blocks. Input and output devices shall not be terminated directly on the PLC hardware terminals. Wiring to spare inputs and outputs shall bear the I/O number as the wire number. Direct wiring of panel components and field devices on the PLC cards is not permitted.

J. Circuit Isolation and Protection

1. Separate single-pole circuit breakers are required to isolate and protect each of the following:
   a. PLC power supply
   b. HMI
   c. 24Vdc Power Supply
   d. Instrument Field Power
   e. Panel Receptacle
   f. Panel Heater (determine if needed)
   g. Air Conditioner (determine if needed)
   h. Enclosure Fans
   i. PLC Output Group

j. PLC Input Group
k. UPS Load Side Power
l. Communication/Network/Interface Equipment

K. Power Circuit Isolation and Protection

1. Separate circuit isolation and protection are required for each of the following:
   a. Control Panel Main – Fused or CB Disconnect with either a Lockable Front Door Mounted Rotary Operator or Lockable Flange Mounted Operator
   b. Motor Starters – Circuit Breakers with Adjustable Trip
   c. Variable Frequency Drives – Fuses as Specified by VFD Manufacturer
   d. Control Transformer Primary - CB or Fuses (where required)

3.3 CONTROL PANEL PLC PROGRAMMING

A. The Contractor shall create each respective Control Panel PLC program to include, but not be limited to, the following:

1. Logic, data, and descriptions not relevant or used (old code) shall be removed prior to FAT and/or SAT.
2. Device and equipment start/stop, sequence, interlocks, setpoints
3. Process control
4. Auto and Manual control
5. Alarm, Events, Trends
6. Alarm, Event, Trend interface with Contractor's HMIs and to Owner's SCADA
7. Setpoint and Control interface with Contractor's HMIs and from Owner's SCADA
8. Network communications interface with Owner's SCADA
9. The program shall be written in a fault-tolerant manner to prevent frequent operator intervention.
10. The program structure shall be divided into subroutines for each logical process and equipment group. Communication routines and data shall be in respective separate subroutines.
11. All analog data values shall be scaled in the program. The scaled value shall represent the real final value. Scaling in the HMI and SCADA is not permitted.
12. Programs shall be written in ladder format. Programs shall be fully documented with rung and address comments. Comments at the start of new logic routines. Provide I/O listings, address, data usage, and configuration printouts. All data table words shall have descriptions.

3.4 CONTROL PANEL HMI PROGRAMMING

A. The Contractor shall create each respective control panel HMI program as outlined herein. Screen graphics, details, and layout shall take advantage of the screen size and resolution. Screens and functions shall be intuitive, text size easy to read, and easy

intuitive navigation. The main overall pump and well screen graphic shall be the default home screen. Dark screen saver shall be used for periods of inactivity greater than 30 minutes.

B. The Contractor shall accurately depict equipment and devices for the respective system. Box or circle outlines representing equipment and devices or P&ID symbols will not be accepted. The contractor shall provide moving and/or color animation for all moving or rotating pieces of equipment, devices, and fluid flow, including but not limited to: motors, pumps, fluids with flow status in pipes.

C. HMI Animation Color

1. Screen animation color shall be as follows, unless otherwise indicated:
2. Fault, Overload, or Alarm – Flashing Red
3. Equipment or Device Running – Solid Green
4. Equipment or Device Stopped – Solid Red
5. Start Button – Solid Green
6. Stop Button – Solid Red
7. Valve Open - Solid Green
8. Valve Closed – Solid Red

D. HMI Common Screen Features

1. Time and date
2. Screen name
3. Login/out button
4. Display the user name currently logged in
5. Screen Menu Navigation “Tree”

E. HMI Alarming

1. Provide an alarm summary screen that displays the alarms in order as they occurred and the acknowledged or unacknowledged status. The alarm descriptions shall be concise so that the operator can understand the exact nature of the alarm condition. The time and date the alarm occurred shall be displayed for each alarm. Provide alarm acknowledgment and alarm clearing features. Acknowledged points that are not in alarm shall automatically clear from the Alarm Summary.
2. Alarm status color is as follows:
    a. Red and flashing – unacknowledged and in alarm
    b. Red and not flashing – acknowledged and in alarm
    c. Blue – unacknowledged, was in alarm but cleared

3.5 HMI SCREEN SECURITY

A. HMI screens shall be set up with a minimum Admin access for full access and control, Operator Level for setpoint changes, and View user access for view-only access and acknowledging alarms. Coordinate with the Owner on all levels of access required.

B. Coordinate with Owner on users' names, passwords, and respective access levels.

3.6 HMI - FAT TESTING

A. The Contractor shall assemble and integrate the factory test setup as specified to prove the performance of the system satisfies all requirements, including system communication requirements, in accordance with the approved test procedures. The FAT shall take place during regular daytime working hours on weekdays. Model numbers and software revisions shall be identical to those that will be delivered to the site. The contractor shall execute the FAT test with the Owner/Engineer as witness. The FAT setup shall include the following:

1. Completed and operational control panels with hardware and software as specified.
2. PLC's communicating with HMI as specified.
3. HMIs and PLC's fully programmed as specified.
4. Field devices and instruments shall be simulated utilizing wired toggle switches for digital inputs and 4-20mA sources for analog inputs to demonstrate field functions, program interlocks, sequences, and HMI alarms.
5. All control panel front door devices and equipment are wired and operational
6. Motor starters and VFDs are operational

B. The Contractor shall submit the FAT test execution plans for review. The FAT shall not be scheduled until the Owner/Engineer has approved the FAT test execution plans. Features and functions outlined below shall be outlined for execution in the FAT test document. At the conclusion of the FAT execution, the Contractor shall make all revisions to the control system as noted in the FAT comments field. A scanned copy of the executed FAT test documents shall be provided to Owner/Engineer at the conclusion of the test. The FAT test document shall include the following:

1. PLC Hardware used.
2. PLC/HMI Software used.
3. Description/List of Test and Simulation Equipment
4. The FAT test execution plans shall be created in Excel in the sample format shown below, including the Test Name, Step, Procedure, Result, with respective entries for Pass, Fail, Initials, and Comments.

PUMP XSTART/STOP AUTO/MANUAL						
Test #		Test Steps	Pass	Fail	Witness Initials	Comments
1	Procedure	Change Pump XMode to Manual Mode				
	Procedure	Press Pump XStart Button on HMI				
	Result	Verify Pump is Running				
	Result	Verify Pump indicates Running on the HMI				
	Result	Verify HMI Animations				
2	Procedure	Change Pump XMode to Auto Mode				
	Procedure	Simulate or Create a Required Start Condition				
	Result	Verify Pump is Running				
	Result	Verify Pump indicates Running on the HMI				
	Result	Verify HMI Animations				

5. The FAT test execution document shall also include a list of all PLC I/O addresses with respective columns for “I/O Description”, “Initials”, “PASS”, and “FAIL”.

C. All special testing materials and equipment required to demonstrate compliance with the specification shall be provided by the Contractor. Where it is not practical to test with real process variables, provide suitable means of simulation. These simulation techniques shall be subject to the approval of the Owner/Engineer prior.

3.7 SAT EXECUTION

A. General

1. The Contractor shall deliver SAT test execution plans for the test prior to execution for review and approval of the Owner/Engineer. The SAT shall not be scheduled until the Owner/Engineer has approved the SAT test execution plans. Features and functions outlined below shall be outlined for execution in the SAT test document.

2. The SAT test execution plans shall be created in Excel in the sample format shown below, including the Test Name, Step, Procedure, Result, with respective entries for Pass, Fail, Initials, and Comments.

PUMP XSTART/STOP AUTO/MANUAL						
Test #		Test Steps	Pass	Fail	Witness Initials	Comments
1	Procedure	Change Pump XMode to Manual Mode				
	Procedure	Press Pump XStart Button on HMI				
	Result	Verify Pump is Running				
	Result	Verify Pump indicates Running on the HMI				
	Result	Verify HMI Animations				
2	Procedure	Change Pump XMode to Auto Mode				
	Procedure	Simulate or Create a Required Start Condition				
	Result	Verify Pump is Running				
	Result	Verify Pump indicates Running on the HMI				
	Result	Verify HMI Animations				

3. All control system functions, alarms, sequences, inputs/outputs, and operation possibilities shall be demonstrated. Where a function, sequence, or operation cannot naturally occur at the time of testing, it shall be simulated.

4. Control set-points and modes of operation shall be modified through the HMI screen and other operator devices such as pushbuttons, selector switches, and VFD controllers. Password protection shall be verified for all set-point entries and mode changes. The minimum and maximum set-point windows shall be tested for all analog levels.

B. Test Failure Assessment

1. If the SAT test was stopped due to failures, the Contractor shall identify the failures, determine the causes of failures, repair failures, and deliver a written report to the Owner. The report shall explain in detail the nature of each failure, corrective action taken, results of tests performed, and shall recommend the point at which the testing should be resumed. After delivering the written report, the Contractor shall convene a test review meeting at the job site to present the results and recommendations to the Owner. As a part of this test review meeting, the contractor shall demonstrate that the failure has been corrected. Based on the contractor's report and the test review meeting, Owner will determine the restart point and may require the test to be fully or partially rerun. The Contractor shall not commence any required re-testing until after receipt of written notification by Owner.

2. The contractor will not be held responsible for failures resulting from the following: An outage of the main power supply in excess of the capability of any backup power source, provided that the automatic initiation of all backup sources was accomplished. Failure of existing equipment and existing instrumentation, provided that the failure was not due to contractor-furnished equipment, installation, or software.

END OF SECTION 467331

SECTION 432110 - PROGRESSING CAVITY PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. References

1. AISI American Iron and Steel Institute
2. ASTM American Society for Testing and Materials
3. IEEE Institute of Electrical and Electronics Engineers
4. NEMA National Electrical Manufacturers Association
5. SSPC Steel Structures Painting Council
6. NFPA 70 National Electric Code (NEC)

1.2 SUMMARY

A. This section includes the furnishing and installation of two (2) self-priming, positive displacement, progressing cavity pumps for conveying anaerobically digested sludge from Anaerobic Digesters No. 1 and 2 to the sludge dewatering equipment. The Equipment Schedule is provided at the end of this section.

B. Pumps shall be rated for installation in hazardous areas and shall be explosion-proof, Class I, Division 2.

C. Manufacturer shall provide pumps with an in-place maintenance design, which allows to replace the rotor and stator without having to disconnect the pump from the suction or discharge piping.

D. Each pump assembly shall include drive shafts, couplings, in-line motor assemblies, drive bases, pump bases, anchor bolts, and all required appurtenances and instrumentation, furnished complete and installed, ready for service, as shown on the Drawings and specified herein.

E. Each pump shall be connected to the existing Local Control Panels serving Sludge Pumps P-11 and P-12, located on the first-floor electrical room of the Sludge Handling Building. Each Local Control Panel includes an ABB 15 HP Variable Frequency Drive (VFD) and local speed controller; “Hand-Off-Auto” selector switch with “Auto” pilot light; “Start” and “Stop” push buttons; “Fault Reset” push button, and a run-time meter. The Screw Press Vendor shall integrate the existing local control panels into their control system. See Control System Appendix #1.

F. Each existing pump utilizes an obsolete ONYX SMART BOX and sensor as an interlock to the existing VFD to prevent the pump from running dry. Press Vendor

shall furnish and install a new monitor system to prevent the pump from running dry. See Control System Appendix #1.

G. Each Sludge pump shall have a field disconnect located at the pump. The disconnect shall have an AUX contact of the handle wired back to the VFD as an interlock. When the disconnect is in the OFF position, the VFD will stop and NOT be allowed to start.

H. The Work shall include all manufacturer-supplied motors, instrumentation, and all electrical and control work necessary for proper operation, including conduit, wiring, and control interfacing, in accordance with the requirements of Division 26 by the Electrical Contractor.

I. The Contractor shall furnish all labour, materials, equipment, products, incidentals, and testing necessary to provide a complete and operational system. Install the system at the locations indicated on the Drawings and in accordance with these Specifications.

J. Coordinate all work with this equipment with any other related equipment installed or specified under other sections of these Specifications.

K. The Supplier shall review the intended application and operational requirements of the pump system and shall recommend the pump that best satisfies the specified requirements.

L. All work performed under this section shall be in accordance with all approved trade practices and manufacturer's recommendations.

1.3 QUALITY ASSURANCE

A. In addition to the requirements of these specifications, comply with the manufacturer's instructions and recommendations for work.

B. Provide equipment that is a standard product of the manufacturer.

C. The pumps, gear reducers, and motors shall be a product of the manufacturers regularly engaged in the manufacturing of equipment having similar service and equal size for a minimum of ten (10) years and a minimum of 20 installations at equivalent applications. Supplier shall provide a list of names and dates of installations for verification by the engineer or Owner’s Representative.

D. Factory test each pump using water with a factory-certified motor, the same size as that specified. Tests shall consist of checking each pump at its rated speed, head, capacity, efficiency, and brake horsepower; and at such other conditions of head and capacity to properly establish the performance curve. Submit copies of the performance curves to the Contractor for the Engineer's review before releasing the pumps to the Contractor. The standards of the Hydraulic Institute shall govern the procedures and calculations for these tests.

E. All pumping equipment furnished under this Section shall be of a design and manufacture that has been used in similar applications, and it shall be demonstrated to the satisfaction of the Owner that the quality is equal to equipment made by that manufacturer specifically named herein.

1.4 SUBMITTALS

A. General: Submit the following in accordance with the conditions of the Contract and Division 1 Specification Sections.

B. Product Data: Submit the manufacturer's technical data and installation instructions, including certified pump curves with efficiency, capacity, head, speed, brake horsepower required, and operating point required for each pump.

C. Shop Drawings: Submit the manufacturer's technical data and installation instructions, including certified pump curves with efficiency, capacity, head, speed, brake horsepower required, and operating point required for each pump.

1. Complete description in sufficient detail to permit an item-by-item comparison with the Specification. Complete description in sufficient detail to permit an item-by-item comparison with the Specification,
2. Dimensions and required clearances,
3. Pump with motor weights
4. Performance data, including pump curves showing overall pump efficiencies, low rate, head, break horsepower, motor horsepower, speed, and shut-offhead.
5. Materials of construction
6. Layout drawings for all equipment showing installation details and anchor bolt layout.
7. Wiring diagrams for all electrical equipment.
8. Deviations from Contract Documents.
9. Manufacturer's installation and testing instructions.
10. Manufacturer's standard guarantee.
11. Certification from the pump supplier that site conditions have been examined.

D. Maintenance and Operating Instructions, including the following additional information:

1. Recommendations for short and long-term storage.
2. Explanation of operating safety considerations.
3. Detailed installation instructions, with clear step-by-step points on the correct mechanical and electrical installation procedures.
4. Repair parts and maintenance materials.
5. Troubleshooting data.
6. Repair data.

7. Manufacturer’s warranty.

1.5 DELIVERY, STORAGE, AND HANDLING

A. All equipment shall be delivered in the largest pieces practical for field assembly by the Contractor. Individual pieces shall be permanently tagged with welded erection marks or stainless-steel tags cross-referenced with information on the manufacturer's erection and assembly drawings.

B. Packing, Shipping, Handling, and Unloading.

1. Comply with Section 016600, Product Handling and Protection.

C. Acceptance at Site.

1. Inspect all equipment and materials against the reviewed Shop Drawings at the time of delivery.

2. Equipment and materials damaged or not meeting the requirements of the reviewed Shop Drawings shall be immediately returned for replacement or repair.

D. Storage and Protection

1. Carefully prepare for storage and label all equipment and materials after they have been inspected.

2. Store all equipment and materials in a dry, covered, ventilated location and protect from harm according to the manufacturer's instructions.

1.6 SEQUENCING

A. Comply with Section 011100 Summary of Work.

1.7 WARRANTY

A. The pump manufacturer shall guarantee the complete pumping assemblies for a period of 12 months after acceptance or eighteen (18) months from the date of delivery, unless noted otherwise within the specifications.

B. Any defects found within the warranty period shall be replaced if damaged or defective in the normal use of the equipment at no cost to the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with specified requirements, supply the progressing cavity pumps from one of the following manufacturers:

1. Netzsch Pumps

2. Moyno Pumps, EZStrip type

3. Or Engineer Approved equal.

B. Contractor choosing an alternative shall refer to the Bid Form. Any proposed alternative must provide all of the qualities described within this specification along with the bid.

2.2 PUMP CONSTRUCTION

A. General:

1. The pumps shall be heavy-duty, positive displacement, single-stage, progressing cavity type. The pumps shall be cradle-mounted, allowing the normally vertical suction port to be rotated 90 degrees clockwise or counter-clockwise to facilitate piping connections.

2. Progressive cavity pumps shall be provided with an in-place maintenance design that permits removal of the rotor, stator, drive shaft, and joint components without disconnecting suction or discharge piping, removing the pump casing, or re-aligning the drive.

B. Pump Suction and Discharge Casing

1. The pump casing shall be designed for the type of service specified and shall be of sufficient strength, weight, and metal thickness to ensure long life, accurate alignment, and reliable operation.

2. The casing shall have multiple 3/4-inch FNPT connections (minimum 4) for vents, drains, and gauges. The connections shall be at the highest and lowest points of the housing regardless of suction orientation.

3. The pump housing shall be constructed as such to allow for easy access to both joints without having to disconnect piping or remove most of the housing.

4. The suction body of the pump shall be oversized at the entrance of the rotor and stator pumping elements to allow the free flow of high solids materials.

5. The rotor joint head shall be recessed from the stator, and the leading edge of the stator shall be chamfered to prevent restriction of flow into the pumping elements. If the pump does not incorporate these features, a rag deflector shall be provided.

C. Stator

1. The pump’s stator shall be formed from a single piece of Buna-N rubber molded inside a single-piece carbon steel casing. Additional hardware to seal around the stator shall not be accepted. Split stators or stators with sealing lines are not acceptable as they can potentially leak.

2. The stator shall be fastened to the suction casing by the use of four (4) tie-bar bolts for easy removal and replacement. Stators shall not be affixed to the suction casing by threaded connections or by snap rings. The stators not using tie bar bolts shall not be accepted.

3. The suction edge of the stator shall be chamfered to allow for unrestricted flow into the pumping elements.

4. The seal shall be integral to the stator sleeve at the suction and discharge to prevent leakage. The use of separate O-rings or flat rings for stator sealing shall not be required.

5. Stator designs that limit pressure capability to less than 90 psi per stage shall not be acceptable. Each stage shall be rated at 90 psi with the capability of a 1.5x hydrostatic test.

6. The removal of the stator shall not require any disconnection of the suction or discharge piping. Pump shall be full service in place. Deviations or special adaptors are not allowed.

D. Rotor:

1. The rotor shall be precision machined from SAE 4140 tool steel or Type 316 stainless steel and coated with N.Durance® tungsten carbide fusion coating to a surface hardness of 1300 to 1500 Vickers to resist abrasion.

2. Tungsten carbide coating shall be applied using a high-velocity spray process with particle velocities in the range of 2,000 to 3,300 ft/sec and an application temperature of approximately 1,830°F to ensure uniform coating thickness and proper metallurgical fusion to the base metal. The minimum finished tungsten carbide coating thickness shall be 0.020 inch.

3. Hard chrome coating is acceptable as an alternative. Rotors furnished with hard chrome coating shall be precision machined from tool steel with a chromium content of 11 to 13.5 percent, heat treated to a hardness of Rockwell C 57–60, and finished with heavy layers of hard chrome plating with a minimum total coating thickness of 0.010 inch.

4. Rotors coated using the HVOF (High-Velocity Oxygen Fuel) process are <u>not</u> acceptable. HVOF operates at higher flame temperatures, which may cause metal warping, provides reduced fusion depth into the base metal due to lower particle velocity, and results in lower ductility with an increased potential for cracking.

5. The rotor shall extend beyond both ends of the stator when assembled to ensure full sealing line engagement and maximum stator utilization. Rotors that are shorter than, or do not extend past, the stator ends when assembled are not acceptable.

6. Rotor removal shall not require disconnection of suction or discharge piping. Rotor disengagement shall be accomplished by the removal of a single bolt only. The use of multiple fasteners, snap rings, sleeves, clips, wedges, special adaptors, or disconnection of the drive joint is not acceptable.

7. Removal of the rotor and stator shall be accomplished with the rotor joint remaining intact to allow complete inspection and maintenance.

8. Access to the rotor disconnection area shall provide a minimum of 2 inches of clear working space in all directions to permit safe and efficient servicing.

E. Joints

1. The rotor shall be connected to the drive shaft by means of a connecting rod with high-strength, shock-resistant universal joints. The universal joints shall be sealed pin-type, lubricated by oil. Grease is not acceptable.

2. The Pin joint shall be sealed with a stainless steel 316 sleeve with O-rings and held in place with circlips. Joints that use band clamps and hoses are not acceptable as they are not as robust.

F. Drive Train

1. The rotor shall be driven by means of a heavy-duty sealed drive train. The rotor shall be joined to the drive shaft by means of a connecting rod with sealed pin-type universal joints at each end.

2. The connecting rod shall be a two-piece design to allow for the rotor and stator to be removed from the suction housing together, either up or off to the side. Horizontal removal is not acceptable. Disassembly of a joint is not acceptable.

3. The connecting rod shall be joined and driven by hardened pins. Using screws or bolts to transfer rotational thrust is not acceptable.

4. The sealed pin-type universal joints shall be factory lubricated with oil and completely sealed from the abrasive fluid being pumped, utilizing a metal cover over the pin and a flexible rubber seal on the connecting rod end. Grease lubrication shall not be accepted.

5. The joint seal shall not employ sacrificial parts such as clamp bands and shall not require special tools to assemble.

6. To optimize seal and pin joint life, the connecting rod shall be of sufficient length to maintain its operating angle within 1 degree. Flexishafts, cardin joints, gear joints, and unsealed pin joints are not acceptable.

G. Pump Drive Shaft

1. The drive shaft shall be of the solid drive shaft design in order to avoid clogging and/or trapping of solids, which could either interrupt the movement of the connecting rod or disturb the seal of the rear pin joint. Maximum shaft deflection under normal operating conditions shall not exceed 0.002”. Hollow or telescoping drive shafts are not acceptable.

2. The drive shaft shall be connected to a flanged gear reducer by a pin in a close-coupled design to reduce the space needed for a coupling.

H. Bearings (if applicable to pump configuration)

1. The bearings shall be of the grease-lubricated, tapered roller bearing type with diverging pressure angles for maximum shaft stability. Bearings are to be designed for a minimum B-10 life of 100,000+ hours under maximum operating conditions and will not require periodic re-lubrication. The bearings shall be protected from contaminants by means of a bearing cover plate bolted to the bearing housing.

2. The bearings shall be enclosed in separate housing, incorporating a bearing spacer and bolted bearing cover, eliminating bearing shimming.

I. Shaft Seal

1. Progressive cavity pump shall be furnished with a factory-assembled, cartridge- or component-type mechanical shaft seal. The seal shall be pre-set, pre-aligned, and fully unitized by the manufacturer to eliminate field adjustment and minimize installation errors.
2. Seal design shall be suitable for continuous operation with abrasive sludge service and shall withstand the full range of pump operating pressures and temperatures without leakage.
3. Seals shall be constructed of corrosion-resistant materials. Stationary and rotating seal faces shall be designed for long service life and be rated for the specified pump duty conditions.
4. Seal flush, quench, or barrier arrangements, when required for specified service, shall be factory-provided and fully compatible with the pumped media.
5. Shaft seals shall be designed for operation without the use of external flushing water.
6. Acceptable manufacturers include John Crane, A.W Chesterton, or an approved equal.

J. Drive arrangement

1. The pumps shall be directly connected to the motor via a motor-to gear reducer, with or without a flexible coupling.

K. Gear Motor:

1. Gear motors shall be furnished with Totally Enclosed Fan Cooled (TEFC), premium-efficiency motors with Class F insulation and a minimum service factor of 1.15.
2. Motors shall be inverter duty and suitable for operation with a variable frequency drive with a minimum 5:1 constant-torque turndown ratio.
3. Motors shall be 4-pole and shall be integrally mounted to the gear reducer.
4. Gear motors shall be manufactured by NORD. No substitutions or exceptions will be permitted.
5. Gear reducers shall be parallel in-line or right-angle type with a minimum service factor of 1.4. The gear housing shall be a single-piece SAE 30 gray cast iron casing with internal reinforcements to provide strength and rigidity. Split housings, bolt-on output covers, or bolt-on flanges are <u>not</u> acceptable. The housing design shall prevent oil leakage, oil contamination, and gear-set misalignment.
6. Gearbox drive shafts shall be solidly mounted in two antifriction bearings (ball or tapered roller), oil-lubricated. The gearbox or gear motor shall be removable without requiring the disassembly of the pump.

7. Gearboxes or gear motors shall comply with the Anti-Friction Bearing Manufacturers Association (ABMA) minimum B-10 bearing life requirements and shall provide a calculated bearing life exceeding 100,000 hours at the maximum operating conditions specified.

8. The thermal power rating of each gear reducer shall equal or exceed the nameplate power rating of the drive motor. During continuous operation, sump oil temperature shall not rise more than 100°F above ambient air temperature and shall not exceed 200°F.

9. Gear reducers shall be totally enclosed, oil-lubricated units utilizing antifriction bearings throughout.

2.3 ACCESSORIES

A. Pump dry-run protection

1. The pump shall have a thermal probe attached to the stator to monitor stator temperature.

2. The probe shall be connected to a control that would trigger a switch to activate an alarm and/or shut the pump down to prevent a dry run (not ruin the stator).

B. Over-Pressure Protection: Each pump unit shall be supplied with a silicone-filled isolation ring with a dual-mounted gauge and single-point pressure switch. The pressure ranges for the switch and gauge shall be selected specifically for each specified service. The isolation ring shall be mounted between ANSI flanges, be sized according to the discharge pipe as shown on the plans, and be constructed with a carbon steel body and fittings with a Buna sleeve.

1. A discharge pressure gauge and pressure switch shall be furnished by the pump manufacturer for each pump. The pressure shall read in pounds per square inch. The range of each pressure transmitter shall be 0-200 psig.

2. The pressure switch and gauge shall be protected by a radial gauge isolator capable of covering the full pressure range. Flat diaphragm isolators are not acceptable.

3. The switch shall be SPDT, NEMA 4.

C. Pressure gauges:

1. Pump flanges shall be tapped for gauge connection.

2. Gauge connection shall be 4-inch diameter.

3. Each connection shall include a shutoff needle valve and the necessary length of pipe to allow the mounting of a pressure gauge. The open end of the gauge connection shall be plugged to prevent the accumulation of debris.

4. Each pump shall be supplied with liquid-filled pressure gauge(s) with snubber and diaphragm seal. Liquid shall be a glycerin-water mixture. The suction gauge shall be adequately sized to indicate suction conditions. The gauges shall be properly installed on the pump suction and discharge lines.

5. For the pressure gauges installed on the suction side, the operation range is 0-20 psig.

6. For the pressure gauges installed on the discharge side: the operation range is 0-30 psig

7. Manufacturer: Gauges shall be a product of H.O. Trerice, Ashcroft, Wika, or equal.

D. The Contractor shall provide expansion joints for pump suction and discharge lines. Flexible Expansion Pump Connectors: Expansion joints shall be a rubber spool type of a single, open wide arch design. Joint construction shall consist of a Butyl tube and cover, reinforced with a suitable woven fabric. Joints shall be designed to meet the design pressures and temperature for the system. Expansion joints' ends shall be flanges drilled to 150 lbs class standards and be full rubber-faced and integral to the body. Flange backing rings of cast iron with a built-in support sleeve shall be provided. Expansion joints shall be Flexicraft Industries, Flextra 150 Model, or equal.

E. Data Plates: Attach stainless steel data plates to the pump, showing the manufacturer's name, pump size and type, serial number, capacity, and head rating, and other pertinent data. Attach a special data plate to the pump frame listing the identification of the frame and bearing numbers.

F. Hardware: All machine bolts, nuts, and cap screws shall be hex head. Hardware or parts requiring special tools or wrenches shall not be used.

2.4 CONTROLS

A. Each pump shall be provided with easily identifiable terminal points to facilitate the exchange of the central control functions between the pumps and the process control system, as indicated on the Contract Drawings.

B. The existing Sludge Feed Pumps Local Control Panel Nos. 1 and 2 include the following:

1. Selector switches
   a. Power On/Off selector switch
   b. Hand/Off/Auto modes of operation
   c. Auto pilot light

2. Start/Stop push buttons

3. Fault Reset Button

4. VFDs are included in the Pump Control Panel

5. VFDs pump speed control potentiometer 0-100%

C. General Description

1. The Screw Press PLC system shall control and monitor the Existing Sludge Feed Pumps Local Control Panels No. 1 and 2 via hard-wire signals, including,

but not limited to, run command (DO), run feedback (DI), VFD fault feedback (DI), in remote feedback (DI), and speed command (AO).

2. The Screw Press PLC system shall have Manual/Auto selector switches that allow running the Sludge Feed Pump from the PLC panel in Auto or Manual modes. In Manual mode, the operator will be able to start and stop the Pumps from the HMI screen, as well as adjust the pump running speed.
   a. In the Auto mode of operation, a flow path needs to be established for Pump #1 or Pump #2 with respect to the manual valves located on the pump suction and discharge sides.
   b. Note: Only manual valves are provided on the pump suction and discharge piping, as well as on the feed line to the Screw-Press. Before starting the system in Remote mode, the required flow path shall be established by opening the appropriate pump suction and discharge valves and the Screw-Press feed line valve.
3. The flowmeter is located in the Sludge Handling Building on the sludge feed pump force main to the Screw Press (Control Panel) and is used for flow monitoring.
4. "Local" mode of operation: The "Local" mode of operation is mainly for equipment maintenance; it operates the sludge feed pump directly from the Local Control Panel. This allows an operator to manually run the sludge pump in the event the Screw Press PLC system fails.
5. Interlocks: If the Screw Press stops running, it shall stop the respective sludge feed pump.
6. The sludge pump shall be monitored to prevent the pump from running dry.
7. Alarms - Pump shall automatically stop running if the following conditions occur:
   a. Pump running dry.
   b. Overpressure.
   c. Motor overload
   d. Low-Level alarms and Low-Low Level pump stop.

2.5 SPARE PARTS AND SPECIAL TOOLS

A. Spare parts to be provided for each set of pumps supplied:

1. One (1) complete mechanical seal
2. One (1) rotor
3. One (1) stator
4. One (1) joint kit
5. One (1) complete set of any special tools required to dismantle the pump

2.6 SURFACE PREPARATION AND PAINING

A. Shop Finishing

1. Protect all exposed ferrous metals with a minimum of one coat of shop primer. Apply an additional coat of two-part epoxy to motors, pumps, gearboxes, and other similar equipment.

2. All surfaces must be dry, clean, and free of rust, scale, oil, and grease. Clean steel surfaces by pickling or blasting to a minimum of SSPC-SP6.

3. Surface preparation, application, and minimum DFT millage to be as per the paint manufacturer's published recommendation.

4. Painting shall be in accordance with the manufacturer's standards.

B. Field Painting

1. All rust, scale, dirt, or other foreign matter shall be removed by solvent cleaning, wire brushing, short blasting, or other standard commercial cleaning procedure.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment and accessories in accordance with reviewed Shop Drawings and manufacturer's instructions, as specified herein and shown on Contract Drawings.

B. Furnish and set stainless steel anchor bolts with nuts and washers in accordance with the manufacturer's recommendations.

C. All electrical equipment, conduit, and wiring not indicated on the Drawings, but necessary to provide a complete operating system, shall be provided at no additional cost to the Owner.

D. Electrical Wiring: The external conduit and wiring required for power supply and control to electrical equipment supplied in this Section shall be furnished and installed in Division - 26, Electrical.

E. Motor size: Any deviation in motor size must be approved by the Engineer. Any electrical equipment or wiring that must change to accommodate a different size motor will be at no additional cost to the Owner.

F. The grade and amount of oil and grease shall be in accordance with the manufacturer's recommendations.

G. Initial lubrication required for startup and field test operation shall be furnished and applied in accordance with the manufacturer's recommendations.

3.2 FIELD QUALITY CONTROL

A. The manufacturer shall furnish the services of a qualified representative for a period of not less than one day to inspect and adjust the equipment furnished in this section. This qualified representative shall also conduct such tests as necessary to demonstrate satisfactory operation and to instruct the Owner's personnel in the care and operation of the equipment.

B. The service representative of the Manufacturer shall be present at the site for one (1) workday to furnish the startup services and training of the Owner’s personnel covering the operation, mechanical maintenance, and electrical requirements. If additional service is required due to the mechanisms not being fully operational, at the time of service requested by the contractor, the additional service days will be at the contractor's expense.

C. For the purposes of this section, a workday is defined as eight hours at the Site, excluding travel time.

3.3 TESTING

A. After completion of installation, the pumps shall be completely tested to demonstrate compliance with operating requirements as specified.

3.4 PUMP SCHEDULE

A. Sludge Dewatering Feed Pumps

1.	Location	-	Solids Handling Building
2.	Service	-	Transfer solids from Primary/Secondary Digesters to the dewatering equipment
3.	Fluid type	-	Anaerobically digested blended Primary & WAS
4.	Percent of Solids	-	2% to 7%
5.	Quantity	-	2
6.	Number of stages	-	1
7.	Maximum flow	-	150 gpm
8.	Pump Head	-	60 ft (26 psi)
9.	NPSHr	-	2.4 ft
10.	Maximum pump speed	-	350 RPM
11.	Duty	-	Constant
12.	Minimum motor size	-	7.25 Hp, 460 V/ 60Hz / 3-phases, Class I, Div. 2 Explosion Proof
13.	Motor Speed	-	1770 RPM
14.	Drive	-	Existing ABB 15 HP VFDs

15. Ambient environment - Indoors
16. Fluid temperature - 60-80ºF
17. Type of suction port - Flanged
18. Suction - 6” 125# FF ANSI per ASME 16.5B
19. Discharge - 4” discharge 125# FF ANSI per ASME 16.5B

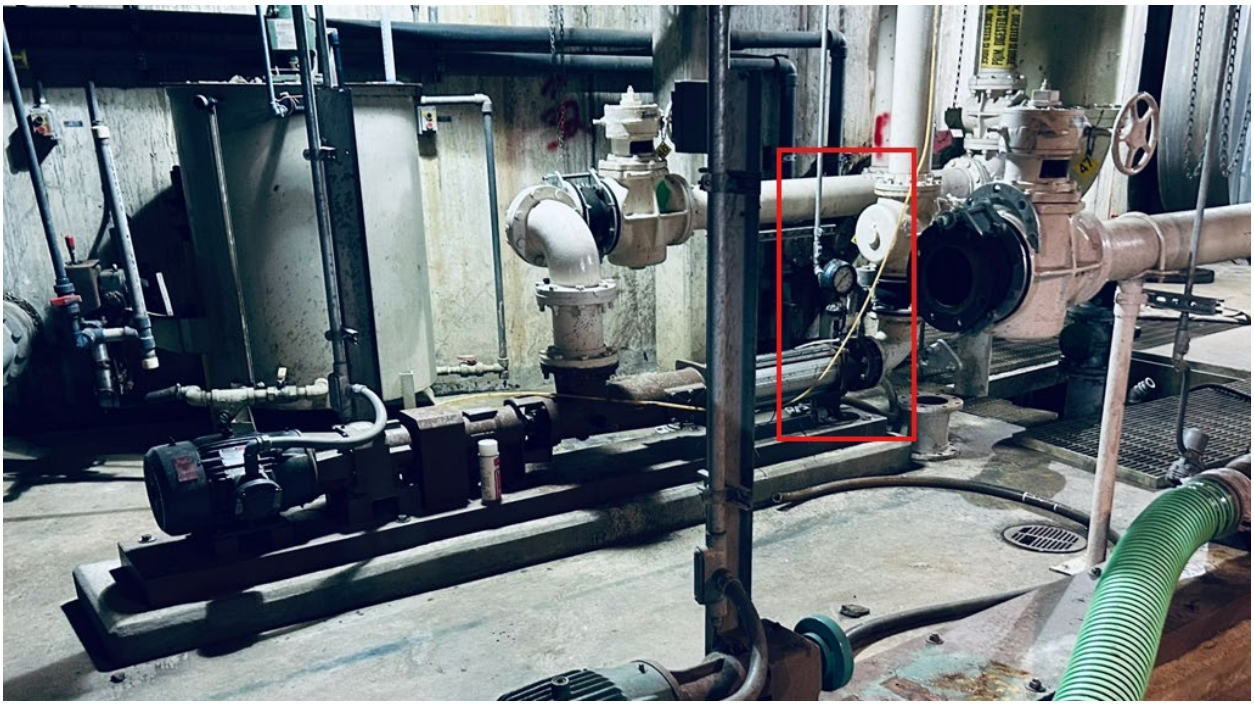
3.5 APPENDIX 1 - EXISTING CONTROL SYSTEM

A. Existing Sludge Feed Pumps and Polymer Blending System - Photographs

Existing Sludge Pumps P11 & P12 Local Control Panels with ABB 15HP VFDs. Located on the first floor, in the Electrical Room.

Existing Sludge Pumps P11 & P12 ONYX Valve Smart Box located next to the local control panels.

Existing Progressive Cavity Sludge Pumps P11 & P12. Located in the basement.



Typical existing sludge pumps pressure sensor/gauge used with the ONYX Valve Smart Box for monitoring pump pressure.


Centrifuge #2 P 11
SVX9000
SVX9000
SVX9000

Existing Poly Feed Pumps P17, P18, P19 & Smart Boxes.
Located on the 1st Floor Polymer Room

Existing Polymer Blend #1 on the left.
Polymer Blend #2 on the right.
Located on the 1st Floor, Polymer Room.

Existing Polymer Tote Transfer Pump.
Located on the 1st Floor, Polymer Room

Existing Poly Feed Pumps P17, P18, P19 & Aging Tank. Located in the Basement

END OF SECTION 432110

SECTION 461211 – SCREW SHAFTLESS CONVEYOR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary conditions, Division-1 Specifications sections, and all Specification Sections apply to work of this section.

B. The following equipment and related work are specified and furnished under other items:

1. Section 467331 – Sludge Dewatering, Section

2. Section 330900 PLC and HMI Control system for panel requirements

C. Reference Standards:

1. American National Standards Institute (ANSI).

2. American Institute of Steel Construction (AISC).

3. American Society of Testing and Materials (ASTM).

4. American Gear Manufacturers Association (AGMA).

5. Conveyor Equipment Manufacturers Association (CEMA 300).

6. National Electrical Manufacturers Association (NEMA).

7. Occupational Safety and Health Administration (OSHA).

8. American Welding Society (AWS D.1.1-90).

9. American Iron and Steel Institute (AlSI).

10. National Electric Code (NEC).

11. Society for Protective Coatings (SSPC).

12. Anti-Friction Bearing Manufacturers Association (AFBMA).

1.2 SUMMARY

A. The Contractor shall provide, install, test, and commission one (1) horizontal shaftless screw conveyor system, including interconnecting chutes, supports, and all other necessary ancillary equipment for a fully operational system. The screw conveyor system is intended to transport dewatered sludge from the dewatering equipment into the cake hopper.

B. The conveyor spiral shall be designed to collect dewatered cake from opposing sides of the screw press and convey it to the chute opening in accordance with the Contract Drawings.

C. The conveyor performance, design parameters, and material of construction are identified in Schedule 461211 – A.

D. The contract drawings and this section outline the equipment descriptions, minimum requirements, and mandatory features for the equipment to be provided. It is the manufacturer's responsibility to design and supply complete equipment that meets all specified details, performance standards, and reliability criteria, in accordance with the intent and requirements of the contract drawings and specifications.

E. The equipment shall be supplied complete with all accessories, special tools, spare parts, and any other appurtenances specified herein or necessary for a proper and satisfactory installation.

F. The exact final dimensions to be determined by the Contractor to suit the dewatering equipment, conveyor system, and final arrangement. The Contractor is responsible for the coordination of all mechanical and electrical equipment and all structural components interfacing with the conveyor, and for obtaining all site measurements necessary to support detailed conveyor submittals.

G. Screw Conveyor with shafts and intermediate hanger bearings will not be acceptable for this project.

1.3 PERFORMANCE REQUIREMENTS

A. The shaftless screw conveyor shall meet the performance and design requirements as listed in Schedule 461211 – A.

1.4 SUBMITTALS

A. General: Submit the following in accordance with the conditions of the Contract and Division 1 Specification Sections.

B. Product Data:

1. Submit Manufacturer's literature, warranty technical data, and installation instructions, complete with accessories, catalog cuts, drawings, specifications, fabrication details, and parts identification for all work of this Section.

2. Manufacturer's certification, signed by a corporate officer, informing that the proposed equipment fully complies with the requirements of this specification.

3. Motor characteristics and performance information.

4. Gear reducer data, including service factor, efficiency, and materials.

5. Parts list, including a list of recommended spare parts.

C. Shop Drawings:

1. Manufacturer's installation drawings. Dimension drawings depicting all mechanical and electrical equipment dimensions and required clearances.

2. General arrangement drawings for the proposed equipment.

3. Submit support locations and loads to the Engineer with shop drawings for review.

4. Submit proposed hanger support locations referenced from the steel columns of the Cake Loading Building and dead and live loads at each point.

5. Cut sheets for electric motors and auxiliary items.

6. Complete schematic diagrams for electrical control panels.

D. Maintenance and Operating Instructions: Maintenance and Operation manuals shall completely describe the operation of the shaftless screw conveyor, start-up, optimization, and maintenance operations for the equipment to be furnished under this section.

1. Recommendations for short- and long-term storage.

2. Detailed installation instructions, with clear step-by-step points on the correct mechanical and electrical installation procedures.

3. Explanation of operating safety considerations

4. Troubleshooting instructions.

5. Electrical diagram.

6. Manufacturer’s warranty.

7. Repair parts and maintenance material.

1.5 QUALITY ASSURANCE

A. In addition to the requirements of these specifications, comply with the manufacturer's instructions and recommendations for work.

B. The design of the conveying system shall be based on the contract drawings, these specifications, and the manufacturer’s proven experience of at least ten (10) years in designing and manufacturing wastewater conveyor systems. Equipment that is purchased and resold, or supplied under a license or marketing agreement, shall not qualify to meet the experience requirement.

C. The screw conveyor system shall be supplied by a single manufacturer and shall include all necessary components, drives, motors, instrumentation, controls, ancillary items, and supports.

D. Any shaftless screw conveyor proposed as an "or equal" design will be subject to the Engineer's approval. If such approval is granted, the Contractor and conveyor Manufacturer will nonetheless be responsible for the resolution of any technical problems arising from the use of the "or equal" design.

1.6 WARRANTY

A. The manufacturer shall warranty the equipment furnished under this section to be free from defects in material and workmanship for a period of twelve (12) months after the equipment was first placed into operation at the jobsite or eighteen (18) months after the equipment was first delivered to the site, whichever date occurs first. Any warranted

material defects found to exist shall be corrected (repaired or replaced) at no cost to the Owner.

B. Liner: For a wear indicator (two colors) liner, excessive wear shall be indicated by the appearance of the bottom indicator layer (second color) along more than 30% of the conveyor length during the first three years of service. If these wear indications occur, the conveyor supplier shall provide a new formed and banded liner to replace all the liners in the conveyor that have excessive wear.

1. Screw: Excessive wear on the screw shall be indicated by loss of more than 50% of the height of the main outer screw section over 30% of the total length of the screw. If excessive screw wear is found, the conveyor supplier shall provide a new screw to replace the screw in the conveyor that has excessive wear.

1.7 JOB CONDITIONS

A. To be delivered in assembled match-marked sections ready for final installation, without the need for field welding. Knocked-down kits of parts will not be acceptable.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers

1. Esmil Group

2. Or an Engineer approved equal.

2.2 GENERAL

A. The conveying system shall be of the shaftless screw type with end bearings. Screw conveyor system with intermediate hanger bearings will not be accepted for this project.

B. All welds to be continuous unless otherwise specified. Facing surfaces of field-welded components shall be beveled and match-marked.

C. Sharp corners of all cuts and sheared edges shall be made smooth by edge grinding.

D. The shaftless screw conveyor equipment shall include the following components:

1. Troughs, Liners & Covers
2. Spiral Flighting
3. Chutes
4. End Shaft
5. Electric motor & gear
6. Mounting and support Structure
7. Safety Accessories
8. Spare Parts

2.3 MATERIALS

A. Materials used in the fabrication of the equipment under this section shall conform to the Schedule 461211 – A:

B. Trough:

1. The U-shaped trough shall be fabricated from AISI 304 stainless steel.
2. The minimum trough thickness shall be 14 gauge (2 mm).
3. Trough end flanges, welded to each trough section, shall be provided for connecting adjacent sections or attaching end plates to the trough sections.
4. Conveyors longer than the maximum individual trough segment length shall be constructed in two or more sections, bolted together at the trough end joining flanges.
5. The screw conveyor trough shall be fitted with a 2-inch diameter NPT drain nipple at the lower end, complete with a threaded cap.

C. Covers:

1. A sectional AISI 304 stainless steel plate shall cover the entire trough, except where the inlet chute connections are located. The cover segments at the inlet chute connections shall extend beyond the connections on each side and be bolted in place.

2. The covers shall be designed to open for maintenance and cleaning. They shall be bolted in place, and quick-opening covers will not be permitted unless equipped with limit switches to stop the equipment when the cover is opened.

3. Inlet and discharge hoppers or chutes:

   a. Shall be welded or bolted to the equipment as indicated on the contract drawings.

   b. Shall be constructed from the same material as the conveyor troughs.

   c. The conveyor equipment supplier shall provide connection chutes and transition pieces between related equipment.

D. Screw:

1. The screw for the shaftless screw conveyor shall be designed to convey material without a center shaft or hanger bearings.

2. It shall be fabricated from wear-resistant carbon steel with a minimum thickness of 1 inch.

3. The screw shapes shall be cold-formed from continuous bar stock.

4. Field welds may be required at the jobsite by the installer if any conveyor length exceeds shipping or handling limitations.

E. Liners:

1. Conveyor troughs shall be lined with UHMW PE liners.

2. Liners shall be provided in a maximum length of 3.5 ft (1000 mm) sections for ease of replacement during servicing.

3. Each section of liner shall be made of two layers of the same material, each a different color, to provide a visible indication when the liner is nearing the end of its useful life.

4. The liner shall be secured in place with stainless steel clips, permanently welded to the inside of the trough. No fasteners or penetrations through the trough wall shall be allowed.

5. The minimum liner thickness shall be 3/8 inch (10 mm).

2.4 CONVEYOR SUPPORTS

A. Support loadings shall be based on a filled trough, the weight of the conveyor, and the dynamic loading during operation.

B. The Contractor shall coordinate support locations with the conveyor equipment supplier, considering the facility's structural constraints. The conveyor supports shall not restrict access to other process systems and equipment.

C. The conveyor shall be field adjusted as required to meet the manufacturer’s installation tolerances.

D. At a minimum, the conveyor shall be provided with support at the inlet and discharge ends, with intermediate supports as required.

E. The supports shall be shop-fabricated from stainless steel shapes and plates and shall be assembled and fitted to the conveyor before its delivery to the jobsite.

F. Supports shall be constructed from AISI 304 stainless steel.

G. The Contractor shall be responsible for all fasteners, both for hanging and floor anchors.

H. All shop welding shall conform to the latest standards of the American Welding Society (AWS). The supports shall be designed to avoid interference with other equipment or equipment supports.

2.5 POWER SUPPLY

A. All electrical equipment shall conform to the applicable standard of the National Electrical Manufacturers Association (NEMA) and the National Electrical Code (NEC). Both power and control equipment shall be insulated for not less than 600 volts, even though operating voltages may be lower.

B. Power supply to the equipment shall be 460 volts, 60 Hz, 3-phase.

1. Power supply for electrical controls shall be 120 volts, 60 Hz, single phase.

2.6 DRIVE SYSTEM

A. The drive assembly shall consist of an integral gearmotor, mounted directly to the screw shaft. The gearmotor housing shall be made of cast iron, providing complete protection under all operating conditions. Gears shall be manufactured and rated for continuous duty.

B. The gearmotor shall be a parallel shaft type, designed to drive the screw without the need for additional couplings or joints.

C. The gear reducer and drive shall be designed to provide sufficient applied torque to start a fully loaded conveyor.

D. The screw rotational speed shall be achieved through a reduction gear. Input power to the screw drive shall be supplied by an AC variable frequency drive unit.

E. The motor shall have a Totally Enclosed Fan Cooled (TEFC) enclosure.

F. The motors shall have a 1.15 service factor and be energy efficient, suitable for 480V, 60Hz, 3-phase power.

G. Gearboxes and motors shall be factory-assembled on the conveyor, factory-tested, and shipped fully assembled with the conveyors.

H. The drive unit shall be rigidly supported so there is no visible "wobble" movement under any operating condition. In the event of a prolonged power failure or emergency system shutdown, the drive system shall be designed, at a minimum, to start the conveyor from a dead stop with the trough filled at 2 times the design load for loads designed up to 67% fill rate and 1.5 times for loads designed exceeding 67% fill rate.

I. The motors have Class B insulation and NEMA Design B speed-torque characteristics, in accordance with NEMA MG1, Section 12.35 and 12.38. Motors shall be C-face type and furnished in standard NEMA frame sizes.

J. Each spiral conveyor shall be driven by a constant-speed gear reducer motor drive unit mounted to a bellhousing adapter flange attached to the conveyor end plate.

K. The adapter flange shall be designed to direct any material leakage from the conveyor trough to the atmosphere and prevent ingress into the gear reducer or motor drive unit. Direct coupling of the gear reducer or motor drive unit to the conveyor end flange is not acceptable.

L. Gear Reducers

1. Gear reducers shall be AGMA Class II, single- or double-reduction, helical gear units equipped with high-capacity roller bearings. Bearings shall be designed to withstand thrust loads associated with a fully loaded startup condition and shall have a minimum AFBMA B-10 life of 30,000 hours.

2. Gear reducers shall be air-cooled and shall not require auxiliary cooling. Each gear reducer shall be sized with a minimum torque service factor of 1.15 times the absorbed power or 1.10 times the motor nameplate, at the driven shaft speed, whichever is greater.

2.7 SAFETY DEVICES

A. Cable-operated safety stop control:

1. The conveyors shall be equipped with emergency pull cords that activate a dual relay through a mounted emergency stop switch, designed to immediately stop the conveyor and any feeding devices when activated.

2. The pull cord switch shall be housed in an enclosure suitable for the operating environment. The unit shall be model ER6022 by Omron, or an approved equal.

B. Motion sensor:

1. The motion sensor shall be mounted on the side of the conveyor to detect screw or drive shaft failure.

2. The motion sensor shall be housed in an enclosure suitable for the environment. The unit shall be model SITRANS WM100 by Siemens, or an approved equal.

2.8 SPARE PARTS

A. It is recommended that the following spare parts be supplied, as a minimum:

1. One (1) set of liners.

2. One (1) cable-operated safety stop control.

3. One (1) motion sensor.

B. The conveyor manufacturer shall provide any special tools required for the servicing and maintenance of the screw conveyor.

2.9 LUBRICANTS

A. Furnish lubricants of the type and quantity as recommended by the conveyor manufacturer for (start-up) operation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The conveyor shall be delivered by the Manufacturer in fully assembled and complete with hardware and instructions, except for the spiral splices. The assembly shall consist only of joining the sections, anchoring the supports, installing the bolt, and electrical hookup.

B. Install equipment in accordance with reviewed Shop Drawings, and manufacturer's instructions, as specified herein and shown on Contract Drawings.

C. Initial lubrication required for start-up and field test operation shall be furnished and applied in accordance with the manufacturer's recommendations.

3.2 FIELD QUALITY CONTROL

A. The conveyor system supplier shall furnish the services at the site of a factory-trained representative for a period of one (1) day in no more than one (1) trip to the jobsite.

Service shall be provided as necessary after the Contractor has installed the equipment. These services shall be furnished for the purposes of:

1. The equipment manufacturer's inspection of the equipment following installation by others, to certify that the equipment has been properly installed and is ready to operate, to train the Owner's personnel in the operation and maintenance of the equipment, and to observe and supervise the initial operation of the equipment.

2. If additional service is required due to the mechanisms not being fully operational at the time of service requested by the contractor, the additional service days will be at the contractor's expense.

3. For the purposes of this section, a workday is defined as eight hours at the Site, excluding travel time.

B. After inspection of the installed equipment, the Supplier shall furnish a written report certifying that the equipment has been properly installed and lubricated, is in accurate alignment, is free from any undue stress imposed by connecting piping or anchorage, has been operated under full load conditions, and that it operates satisfactorily.

3.3 DEMONSTRATION AND INSTRUCTIONS

A. Provide the services of a qualified factory-trained manufacturer's representative to conduct training covering operation, mechanical maintenance, and electrical requirements.

3.4 SHAFTLESS SCREW CONVEYOR SCHEDULE

SCHEDULE 461211 – A

Location	**Sludge Handling Building**
Performance	
Material conveyed	Sludge cake, ~ 22% TS
Density average,	50 lbs/cu ft
Design capacity,	up to 200 ft^3/hr
Max screw speed	>20 rpm
System Design	

Trough length	As shown on the Drawings
Inclination angle	Horizontal
Rotation direction	Bi-directional
Screw Type	Shaftless
Screw Diameter, inch	12 inches
Feed Inlet	Screw Press
Discharge outlet	Chute to dumpster
Number of Inlets	1
Number of Discharges	1
Drive Type	Helical Gear
Power Supply	3 HP, 460 V/60 Hz/3-ph
Trough Drainage connection	NPS 2, threaded
Screw Material	S355J2G3 steel
Material of Construction	
Body	AISI 304, 11 ga (3 mm)
Cover	AISI 304, 14 ga (2 mm)
End Plate Type	Welded
Liners	UHMW PE, 0.4 in (10 mm)
Screw	S355J2G3 steel
Supports	AISI 304 stainless steel
Gearmotors	painted cast iron
Hardware	AISI 304 stainless steel
Lid Type / Length	Bolted / 5 ft max

END OF SECTION 461211

SECTION 463333 – POLYMER BLENDING AND FEED EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. The following equipment and related work are specified and furnished under other items:

1. Section 467331 – Sludge Dewatering

2. Section 330900 PLC and HMI Control System

1.2 SUMMARY

A. This section includes furnishing, installing, and placing into successful operation two (2) complete polymer blending skid systems with progressive cavity pump, motors, and controls, including all integral piping, valves, fittings, pipe supports, special equipment, and appurtenances in accordance with this specification, including all incidental work necessary to make it complete, satisfactory, and ready for operation.

B. The polymer dilution and feed system shall be capable of effectively activating and fully blending with water a homogenous polymer solution.

C. Polymer blending system shall operate in conjunction with sludge dewatering equipment as specified in Section 467331– Sludge Dewatering. All equipment shall be delivered as part of the complete dewatering skid-mounted system.

D. Polymer blending system shall be rated for installation in hazardous areas and shall be explosion-proof, Class I, Division 2.

1.3 SYSTEM DESCRIPTION

A. The polymer dilution and feed system shall be capable of effectively activating and fully blending with water a homogenous polymer solution ranging from 0.1 to 2% concentration based on neat emulsion polymer with active contents of 30-50%.

B. Design Requirements for the Polymer Feed System:

1. Polymer shall be drawn from a tote located next to the polymer feed system, as shown on the Drawings.

2. Polymer Type: Emulsion.

3. Polymer Activity (percent active): 30 to 50.

4. Solution Concentration Range: 0.1% to 2% based on neat polymer.

5. Solution Concentration Design Point: 0.5% based on neat polymer.

Neat Polymer Flow Range gph	Dilution Water Range gph
0.5–15	60–1200

C. Performance Requirements: Polymer Feed System shall be capable of supplying between 0.5 and 15 gallons per hour of liquid emulsion polymer, with the entire flow passing through the preparation unit. Following preparation and mixing, the polymer solution leaving the mixer shall be ready to feed the dewatering volute press unit.

1.4 SUBMITTALS

A. Product Data: Provide unit capacities, projected effluent values, loading parameters, design parameters, oxygen requirements, dimensions, etc.

B. Shop Drawings:

1. Submit detailed specifications and shop drawings with both shaded isometric and orthogonal views of the proposed system, including dimensions and weights.

2. Submit wiring, control schematics, and control logic diagrams for all electrical and control components furnished.

3. Factory testing documentation.

C. Provide detailed Operations and Maintenance Manuals, including storage, installation, start-up, and operating instructions. Provide safety precautions and warnings for all hazards operating equipment.

1.5 QUALITY ASSURANCE

A. In addition to the requirements of these specifications, comply with the manufacturer's instructions and recommendations for work.

B. All equipment included in this section shall be furnished by a single supplier who shall be responsible for the design, coordination, and satisfactory operation of the system.

C. Provide evidence of at least fifteen (15) years of demonstrable experience in the design and manufacture of polymer blending systems. The Supplier shall have at least twenty-five (25) polymer feed systems operating successfully for at least five (5) years in North America at municipal wastewater treatment plants that were designed and furnished under the Supplier’s own name.

D. Prior to shipment, the system shall be inspected for quality construction, verifying all fasteners and fittings are tight, all wires are secure, and connections are whisker-free.

E. The complete system shall be fully factory tested prior to shipment. Testing shall include setting and verification of all instrumentation and sensors per the design requirements of the application; pressure testing all plumbing systems for a minimum of one hour at 100 psi. If leaks are found, they shall be fixed, and a new test shall be conducted for one hour at 100 psi until the plumbing system is verified to be leak-free: verification of system design flow rates, and complete function simulation of operation.

1.6 DELIVERY AND STORAGE

A. The equipment shall be shipped in a new, high-quality, completely enclosed weatherproof wooden crate.

B. The crate shall include a shock sensor to warn of equipment mishandling during shipment.

1.7 WARRANTY

A. The manufacturer shall warranty the equipment furnished under this section to be free from defects in material and workmanship for a period of twelve (12) months after the equipment was first placed into operation at the jobsite or eighteen (18) months after the equipment was first delivered to the site, whichever date occurs first.

B. Any warranted material defects found to exist shall be corrected (repaired or replaced) at no cost to the Owner.

C. The mixing chamber shall be warranted for the life of the system against plugging for any reason.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. VeloBlend, Model VM-15P-1200-D0A2

2. Or an Engineer approved equal.

B. The listed equipment is part of the Base Bid and shall be considered as establishing the type, function, appearance, and quality required as defined in the General Conditions.

C. The drawings and specifications were prepared based on Velodyne. CONTRACTOR shall include in the Bid and shall be responsible for the cost of any changes, including engineering changes, to accommodate the other Base Bid equipment, including but not limited to structural, mechanical, and electrical work.

D. CONTRACTOR may provide Alternative Bids for equipment from other manufacturers by writing their name into the blank(s) provided on the Bid form. CONTRACTOR shall comply with all provisions regarding substitute items and shall include in the Bid and be responsible for the cost of any changes to accommodate substitute equipment, including,

but not limited to, structural, mechanical, and electrical work. CONTRACTOR shall also pay costs of engineering services for review of substitutes and for revisions of drawings and/or specifications by ENGINEER to accommodate substitutes.

2.2 EQUIPMENT PERFORMANCE

A. The polymer-blending system shall be a complete package that automatically dilutes, activates, and feeds liquid polymer and water. Blenders shall instantaneously invert neat polymer into solution, producing a thoroughly diluted and completely activated homogenous blend, free of "fish-eyes" and unblended polymer.

B. The polymer blending and feed equipment shall be provided to meet the following performance and design requirements:

1. Polymer Type: Liquid emulsion (30-75 percent active)

2. Neat Polymer Feed Rate: 0.5 to 15 gph

3. Diluted Polymer Concentration: 0.1-1% of Total Active

4. Dilution Water Flow Range: 60-1200 gph at 50 psi minimum.

2.3 MULTIZONE MIXING CHAMBER

A. To provide control and versatility to optimize the performance of the wide range of polymers available and to optimize system reliability, a multi-stage hydro-mechanical polymer blending technology shall be provided with both a non-mechanical and mechanical mixing stage:

1. Non-Mechanical Stage: To optimize reliability, the device shall be capable of activating and blending polymer based on plant water pressure alone of 30 psi or greater. Polymer shall be injected directly into a water jet by means of an injection quill positioned such that the non-mechanical mixing energy is not diminished prior to polymer and water contact. The non-mechanical zone shall be designed such that the velocity of the mixing energy-producing water jet is maintained or increases as flow decreases. Polymer activation efficiency shall be consistent over the dilution water range.

2. Hydro-Mechanical Mixing Stage: To provide optimal polymer performance under all operating conditions and to provide total control over mixing energy, in addition to the non-mechanical mixing stage, the device shall be capable of producing its

mixing energy independent of plant water pressure through a variable intensity, controllable stainless steel hydro-mechanical mixer. The mixing impeller shall be fully controllable and capable of inducing ultra-high, non-damaging recirculation through the impeller. The polymer mixing impeller shall be designed to produce both axial and radial flow to optimize mixing effectiveness and induce high, non-damaging mixing energy across the system's full flow range.

3. To prevent polymer build-up, the mixing chamber shall maintain high velocity in the entire chamber – at no time shall there be low velocity within any portion of the mixing chamber.

B. Both mechanical and non-mechanical mixing zones shall be clear polycarbonate to view the mixing action and blending effectiveness. Acrylic chambers prone to becoming brittle over time and cracking, or opaque pipe, shall not be acceptable.

C. The mixing chamber shall have a maximum rated pressure of 100 psi. Provide a 316 stainless steel, adjustable-range pressure relief valve on the mixing chamber set at 75 psi.

D. Impeller shall be driven by a 0.5-hp, 90-volt DC, washdown-duty, TENV motor with a full-load current of 5.0 amps. Impeller speed shall be not less than 1,750 rpm. Motor shall be directly coupled to the impeller shaft. Mixer speed shall be controlled by an SCR speed controller mounted within the polymer feed motor control panel and located outside the hazardous area, unless otherwise listed for Class I, Division 2 service. Motors mounted beneath the mixing chamber, where leakage or seal failure could damage the motor, shall not be acceptable.

E. Motor and all associated electrical components shall be listed and approved for installation in a Class I, Division 2 hazardous location in accordance with the National Electrical Code.

F. The mixer drive shaft shall be sealed by a mechanical seal which shall have an integrally mounted and factory plumbed seal flush. A drain port behind the seal shall be provided in the mixing chamber to drain the polymer solution in case of a seal failure. The seal shall be easily accessible for replacement. All bearings shall be external to the mixing chamber.

G. Neat Polymer Check Valve: Provide a neat polymer check valve specifically designed to isolate neat polymer from dilution water. The valve shall be designed with an open, unobstructed path to the valve seat. Minimum area to valve seat shall be 3/16 inch. The valve body shall be constructed of Teflon with Viton seals, and the ball shall be stainless

steel. The valve shall be readily accessible for cleaning and shall be easily disassembled. Conventional check valves and/or check valves that are installed inside the mixing chamber, or which require mixing chamber disassembly for servicing, will not be accepted.

H. Dilution Water Control

1. If the manufacturer requires two-stream dilution control, dilution water shall be split into two streams. Primary water flow shall supply the mixing chamber. Secondary water flow shall be used to post-dilute the activated polymer stream.

2. Flow indicators and flow control valves shall be provided for the dilution water stream:

   a. The dilution water flow rate shall be monitored by a Rotameter flow meter having the range of 60-1200 gph. Unions of flanges shall be provided on the flow meter to allow easy removal for cleaning.

3. Provide a factory-installed and pre-wired 120 VAC electric solenoid valve for on/off control of dilution water flow. Solenoid valve body shall be 316L SS.

4. A differential pressure type low water differential pressure alarm with 120-volt rated contacts shall be provided. The switch shall be adjustable between 9 and 60 psig. Static working pressure shall be at least 150 psi. The pressure switch shall be as manufactured by Ashcroft, or equal.

5. Dilution water and solution output connections shall be 316 stainless steel unions connected to the chassis.

2.4 DILUTION WATER INLET MANIFOLD

A. The dilution water inlet assembly shall include an inlet fitting, a factory-installed and pre-wired 120 VAC, NEMA 4X dilution water solenoid valve, Rotameter-type flow meter, stainless steel liquid-filled dilution water inlet pressure gauge, and 316L stainless steel water control valves. Plastic control valves shall not be acceptable. The manufacturer shall provide valves in accordance with Division 40.

2.5 NEAT POLYMER METERING PUMP (PROGRESSING CAVITY)

A. Each skid system shall be provided with one (1) neat polymer metering pump integrally mounted on the system’s skid.

1. The neat polymer metering pump shall be a progressing cavity-type pump, constructed of 316 stainless steel rotor and fluoro-elastomer stator. The shaft seal shall be a lip seal type riding on a ceramic sleeve.

2. Motor and all associated electrical components shall be listed and approved for installation in a Class I, Division 2 hazardous location in accordance with the National Electrical Code.

3. The pump shall have a minimum continuous output range of 0.5 to 10 gph.

4. The pump shall contain a minimum of four stages to minimize slip.

5. The pump shall be mounted to the skid frame with a 304 stainless steel bracket that positions the pump suction no more than 18 inches off the base to maintain ideal pump suction conditions.

6. A 120 VAC SCR (Silicon-Controlled Rectifier) variable speed controller with 90-Volt DC, 5.0 FLA, 1/2 HP close-coupled, washdown-duty, TENV motor. Maximum pump shaft speed shall be 545 rpm. The pump speed shall be controlled by an SCR speed controller mounted in the polymer feed motor control panel.

B. Provide a calibration cylinder with one full port PVC ball valves having Viton O-rings. The column shall be calibrated for a one-minute draw-down at maximum pump rate and read in GPH and milliliters. The calibration column shall be rigidly mounted to the system's frame with a minimum of two heavy-duty brackets. Mounting the calibration to the neat polymer inlet piping shall not be acceptable. Provide a breather plug in the top of the calibration column designed to allow adequate displacement of air during calibration while preventing water or other foreign material from entering the calibration column.

C. Provide a thermal-type loss of polymer flow sensor.

D. Pump shall be a progressive cavity pump by Seepex Inc, or equal.

E. Pump shall allow for manual adjustment of the pumping capacity.

F. Provide a factory-installed and pre-wired high-pressure switch on the discharge of the pump. Pressure switch shall be Square D Type GAW, or equal. High-pressure setting shall be set by the manufacturer. The high discharge pressure switch shall shut down the pump in the event of high discharge pressure (On and Remote modes). A manual reset shall be required to restart the pump.

G. Spare Parts: The spare parts shall be identified, prepared, and packed for long-term storage.

2.6 SOLUTION DISCHARGE ASSEMBLY

A. Provide a 2-1/2-inch stainless steel liquid-filled pressure gauge to monitor system discharge pressure.

B. Provide a PVC ball-type check valve to prevent backflow, sized for the total solution flow of the system.

2.7 FRAME/SKID

A. The system's frame shall be of rugged 304 stainless steel construction. All pipe supports shall be stainless steel. Piping and valves shall be mounted with rigid pipe clamps.

B. All components of each dilution/feed assembly, including pump, drive, control devices and instruments, and local control panel shall be factory pre-plumbed and pre-wired.

2.8 CONTROL PANEL

A. The vendor shall furnish, install, and commission a Local control panel for the polymer blending system. The local control panel shall be mounted on the polymer blending skid and pre-wired to all on-skid equipment and instrumentation. Refer to Section 330900 PLC and HMI Control System for panel requirements.

B. All associated electrical components shall be listed and approved for installation in a Class I, Division 2 hazardous location in accordance with the National Electrical Code.

C. The local control panel shall be factory-mounted to the polymer system skid and pre-wired to all skid motors and controls. The control panel shall have all logic controllers, SCR motor controllers, digital displays, potentiometers, switches, lights, relays, and other control devices as required for a functioning system.

D. The polymer system control panel shall have the following devices on the front of the control panel enclosure:

1. Local – Off – Remote selector switch.

2. Manual mixer speed control potentiometer.

3. Manual polymer metering pump speed potentiometer (ten turns).

4. Polymer metering pump flow display (signal based on pump speed).

5. Power on the indicating light.

6. Red “low water differential pressure” alarm indicating light.

7. Red “low polymer flow” alarm indicating light.

E. The Polymer system control panel shall receive the following inputs from the Screw Press Main Control Panel

1. Polymer system start/stop command (discrete dry contact).

2. Polymer metering pump pacing speed signal (analog 4-20mA).

F. Polymer system control panel shall provide the following outputs to the Screw Press Main Control Panel

1. Polymer system “in remote” (discrete dry contact).

2. Polymer system “Running” (discrete dry contact).

3. Polymer system common alarm (discrete dry contact) active when any system alarm is active.

G. Control panel shall accept 120-volt AC, single-phase, 20-amp hardwired branch circuit power. Provide a main control panel circuit breaker disconnect and a dedicated circuit breaker for each motor.

H. All conduit and wiring from the polymer system control panel to the associated polymer system devices shall be factory-prewired or provided by Polymer Feed Equipment Supplier.

2.9 PIPING AND VALVES

A. Piping and fittings shall be Schedule 80 PVC. Solenoid valves shall be 316 or 316L stainless steel.

B. CONTRACTOR shall provide strainer and all unions, piping, fittings, and appurtenances to connect to the emulsion polymer tote, as shown on the Drawings, including 2-inch NPT connection, isolation ball valves, 1-inch quick-disconnect adapter, vent connection, and 20 feet of 1-inch clear, braided, PVC tubing.

2.10 SPARE PARTS

A. CONTRACTOR shall provide, along with the shop drawings, a list of the manufacturer's recommended spare parts for the specified equipment. The list shall include a description of each spare part, current pricing, and expected delivery time for each part. No spare parts shall be provided by CONTRACTOR/manufacturer as part of this Contract.

B. Manufacturer to supply the following spare parts:

1. One (1) stator for the neat polymer progressive cavity pump
2. One (1) rotor for the neat polymer progressive cavity pump
3. One (1) progressive cavity pump shaft seal
4. Progressive cavity pump with motor and VFD

C. These parts shall be identified, prepared, and packed for long-term storage.

2.11 FINISHES

A. It is the intent of these specifications that equipment, support, and accessories be furnished factory shop-primed and finish-painted. Equipment and appurtenances shall be prepared in accordance with commercial grade SSPC specifications No. 6. Priming and finish painting shall be as recommended by the manufacturer and shall be suitable for a corrosive atmosphere. Touch-up paint shall be provided by the manufacturer.

2.12 ANCHOR BOLTS

A. Provide all anchor bolts required for the equipment furnished. Anchor bolts shall be 316 stainless steel and shall be of ample strength for intended service. Provide anchor bolts in accordance with Division 5.

PART 3 - EXECUTION

3.1 GENERAL

A. Refer to requirements specified in Division 01 for equipment installation, quality control, testing, supervision, start-up, and operator training.

B. The complete system shall be fully factory tested prior to shipment. Testing shall include setting and verification of all instrumentation and sensors; pressure testing all skid-mounted plumbing systems as specified in Division 40. If leaks are found, they shall be fixed, and a new test shall be conducted until the plumbing system is verified to be leak-free. The system shall undergo factory verification of system design flow rates and complete functional operation. Documentation of each test shall be maintained and provided to the engineer as part of the shop drawing review.

C. Refer to Section 467331–Volute Dewatering Press for startup and performance testing requirements of the dewatering process, including performance of Polymer Blending and Feed Equipment.

END OF SECTION 463333

SECTION 467331 – DEWATERING MULTI-DISK SCREW PRESS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Related Section:

1. Division 26 – Electrical
2. Section 330900 PLC and HMI Control System
3. Section 432110 – Progressive Cavity Pumps
4. Section 461211 – Shaftless Conveyor
5. Section 463333 – Polymer System

C. This section contains references to the following documents:

1. American National Standards Institute (ANSI)
2. American Society of Testing and Materials (ASTM)
3. American Iron and Steel Institute (AISI)
4. American Welding Society (AWS)
5. American Institute of Steel Construction (AISC)
6. American Bearing Manufacturers Association (ABMA)
7. American Gear Manufacturers Association (AGMA)
8. National Electrical Manufacturers Association (NEMA)
9. Underwriters Laboratory (UL).
10. National Electrical Code (NEC)

1.2 DESCRIPTION OF WORK

A. All equipment furnished under this Section shall be provided by a single Manufacturer, who shall be responsible for fabricating or procuring individual components, integrating the complete system, performing factory testing, and delivering the equipment to the Project site. The Manufacturer shall be responsible for coordinating all equipment,

components, and interfaces necessary to provide a complete, properly functioning, and integrated sludge dewatering system.

B. The Manufacturer shall furnish a complete sludge dewatering packaged system, as specified in the Contract Documents, capable of meeting the specified performance requirements and providing a fully functional and coordinated sludge dewatering system. The packaged system shall include, at a minimum, the following components:

1. Multi-Disc Screw Press (hereinafter Screw Press) dewatering unit with sludge condition (flocculation) tank, including Local and Main Control Panels
2. Two (2) Polymer Feed skid system
3. Two (2) Sludge Feed progressive cavity pumps
4. Flowmeter
5. Dewatered sludge cake conveyor
6. Access platforms, as shown in the Contract Drawings

C. The Screw Press shall include a structural frame capable of accommodating (6) dewatering drums. Six (6) dewatering drums shall be furnished and installed to meet the ultimate current capacity.

D. The Screw Press system has been designed based on the Esmil Group Multi-Disc Screw Press, Model MDQ-506CS, which serves as the Basis of Design. Other manufacturers may be considered only if the proposed equipment meets or exceeds all specified design, performance, and operational requirements and fully complies with the site constraints identified in the following paragraph. Named or approved equal equipment may differ in structural configuration, electrical power characteristics, or control systems, provided such differences do not require modifications to the existing facility or supporting systems and comply with all Contract requirements.

E. Equipment Access, Packaging, and/or Engineer-approved as Equal Requirements for the existing Building:

1. Access and Equipment Fit: The Contractor shall demonstrate at the time of bid that all proposed equipment components can be transported and installed within the existing building access limitations. Equipment requiring field modification, disassembly beyond the manufacturer's standard procedures, or alteration of building features to fit shall not be accepted. Any non-compliant equipment furnished shall be corrected entirely at the Contractor's expense, with no adjustment to the Contract Price or Contract Times.

2. Packaged and Coordinated System: All dewatering equipment shall be furnished as a fully coordinated, complete packaged system. Interface gaps, undefined scope, or missing components necessary for a complete and operable system shall be the sole responsibility of the Contractor and shall be provided at no additional cost to the Owner.
3. Equipment Modularity: The proposed equipment shall be modular and suitable for transport and installation within the existing facility constraints. Manufacturers' drawings demonstrating the modular breakdown shall be submitted. Equipment requiring disassembly beyond the manufacturer's recommended procedures shall be rejected.
4. Performance and Future Capacity: The dewatering equipment shall meet the design and operational requirements specified in Paragraph 1.3 and shall be capable of accommodating a minimum of twenty percent (20%) future increase in capacity without structural modification to the equipment, building, or supporting structure. Equipment requiring external aging tanks, oversized vessels, or supplemental process units to meet capacity or performance requirements shall not be accepted.
5. Structural Analysis and Load Certification: The equipment shall be subject to both of the following limits: a maximum floor live load of 250 lb/sf and a maximum total operating equipment weight of 40,000 lb, as shown on the Drawings.
6. Equipment Removal and Clearance: The manufacturer shall certify that all major equipment components can be removed vertically using existing overhead clearances. Equipment requiring horizontal extraction beyond available clearances, crane rail relocation, crane modification, or building structural alterations shall be rejected. The Contractor shall verify all overhead and access clearances for the installation and maintenance requirements as part of the bid.
7. Solids Discharge Alignment: Dewatered solids discharge shall align with the existing cake chute location as shown on the Drawings. New floor penetrations, beam modifications, chute relocation, or structural alterations shall not be permitted.
8. Conveyance System: Where conveyors are required to align the discharge with existing facilities, such conveyors shall be fully integrated with the screw press system and shall be included in the base bid. Field-added conveyance required due to equipment layout non-compliance shall not be permitted.
9. Electrical Constraints: All electrical components and equipment shall be suitable for the designated room classification. Equipment that necessitates increased area classification, special ventilation, or additional electrical or building modifications due to the increased power demand, vapor, heat, or emissions shall be rejected.
10. Approved Equal Requirements: All changes in structural, electrical, mechanical, instrumentation, or plumbing requirements resulting from a proposed "or Engineer-approved equal" shall be the sole responsibility of the Contractor. This shall include

the cost of redesign by the Engineer or the Engineer's subconsultants, as well as any additional costs incurred by affected subcontractors. All revised drawings shall be sealed by a professional engineer licensed in the State of West Virginia. No additional compensation shall be made by the Owner.

11. Burden of Proof: The burden of proving equivalency shall rest entirely with the Contractor. Claims of equivalency based solely on performance, capacity, or advertised ratings will not be accepted.

F. All welding shall conform to the American Welding Society Structural Welding Code.

G. All construction shall allow easy access and visual inspection of all internal components.

H. All electrical work, motors, and drives shall comply with all relevant NEMA standards.

1.3 SYSTEM DESCRIPTION

A. The sludge dewatering system shall consist of the Dewatering Screw press sized to dewater anaerobically digested sludge with the following parameters:

1.	Type of Influent Solids:	Anaerobically Digested Primary and Waste Activated Sludge
2.	Influent Dry Solids Concentration:	3-5% Total Solids (TS) concentration
3.	Max Solids Loading:	2400 lbs DS/hr
4.	Each Screw Loading:	400 lbs/DS/hr
5.	Max Hydraulic Capacity (total):	150 gpm at 3% TS
6.	Dewatered Cake:	20%
7.	Polymer usage:	25 lbs of active polymer/dry-ton solids

B. The dewatering screw press shall be a complete, prefabricated sludge dewatering system, as described herein and shown on the Drawings, consisting of the following:

1. Flocculation and dosing chamber used for flocculation/mixing of the polymer and influent sludge. This tank shall be equipped with a sludge inlet, drainage outlet, polymer (flocculant) inlet, an electric agitator, and a mixer. The feed tubes connect the mixing tank with the dewatering drums.
2. Six (6) dewatering drums run by gearmotors equipped with individual rinsing water systems with nozzles. Each dewatering drum shall have individual fixing elements that can be removed separately while other screws are in operation.

3. The filtrate collection tray shall be provided with flanges for filtrate removal. Side walls of the filtrate collection tray are an integral part of the frame base.
4. A self-contained electrical and control panels, including control for ancillary equipment such as feed pumps, polymer feed, and dewatered solids conveyor.

C. The dewatering system shall integrate all appurtenances necessary for a complete, functional dewatering system operation, including but not limited to the following:

1. Liquid Polymer Blending System
2. Sludge Feed Pumps
3. Flowmeter
4. Dewatered sludge conveyor

1.4 PERFORMANCE TESTING

A. Performance testing must demonstrate that the performance of the dewatering equipment can simultaneously achieve:

B. The screw press system shall have a sludge processing capacity of 2,400 dry pounds per hour, equivalent to 400 dry pounds per hour per dewatering drum. It shall be capable of dewatering anaerobically digested sludge with influent solids concentrations ranging from 3 to 5 percent to a dewatered cake with an average solids concentration of not less than 20–21 percent. The specified capacity and performance shall be achieved at or below the maximum drum rotation speed specified herein

1. Minimum solids capture rate shall be 95% at the rated capacity of the Multi-Disc Screw Press.
2. Stated average performance criteria shall be obtained with a maximum cationic emulsion polymer, with active polymer concentration ≥ 39%, dosage of 18-25 lbs of polymer/dry ton.

1.5 QUALITY ASSURANCE

A. All equipment and components shall be furnished as complete standard type assemblies in accordance with the standards of the industry.

B. All equipment furnished under this section shall be of a single manufacturer who has been regularly engaged in the design and manufacture of the specified equipment.

C. To ensure unity of responsibility, the Screw Press, supporting frames, polymer mixing and feeding blend unit, conveyors, and control systems shall be furnished and coordinated by a single supplier. The Contractor shall assume full responsibility for the satisfactory installation and operation of the entire dewatering system package.

D. The Supplier shall have at least ten (10) full-scale systems utilizing the exact technology at the same scale size proposed for this project operating successfully for at least three (3) years in North America at municipal wastewater treatment plants that were furnished under the manufacturer's own name.

E. Prior to shipment, the Dewatering Screw Press and control panel shall be factory tested at the place of assembly. Factory test each pre-assembled, pre-wired, Multi-Disc Dewatering Screw Press and its associated control panel to be supplied to the job site. Prior to shipment, verify through a one-hour continuous operating test that the Multi-Disc Dewatering Screw Press and associated equipment operate smoothly, noiselessly, vibration-free, and without overheating of any bearing or motor.

F. The owner/engineer shall, at their option, be permitted to witness the factory quality control test at the manufacturer's facility. The manufacturer shall give the owner/engineer a minimum of one (1) weeks' notice prior to testing.

G. The equipment furnished shall be fabricated, assembled, installed, and placed in proper operating condition in full conformity with approved drawings, specifications, engineering data, and/or recommendations furnished by the equipment manufacturer. The equipment manufacturer shall, in addition to the Contractor, assume the responsibility for the proper installation and functioning of the equipment.

H. In addition to the requirements of these specifications, comply with the manufacturer's instructions and recommendations for work. All equipment shall perform as specified, and accessories shall be provided as required for satisfactory operation.

1.6 SUBMITTALS

A. Submit manufacturer's technical data and application instructions per Section 013323.

B. Product Data: Submit manufacturer's technical data and application instructions.

C. Shop Drawings:

1. Contractor shall submit Shop Drawings for all equipment furnished under this Contract. Shop Drawings shall clearly identify the equipment, materials, and components proposed for incorporation into the Work and shall include quantities, dimensions, orientations, mounting and connection details, layouts, electrical control diagrams, wiring schematics, accessories, and all other information necessary for the Engineer to determine compliance with the Contract Documents.
2. Shop Drawings shall be complete and coordinated and shall be reviewed and approved by the Contractor for completeness and compliance with the Contract Documents prior to submission. Each submittal shall bear evidence of such Contractor review before being transmitted to the Engineer.

D. Shop Drawings: Submit for review the following:

1. Dimensional drawings depicting all mechanical and electrical equipment dimensions and required overhead clearances.
2. Equipment layout, principal dimensions, with related verifications required for installation, including anchorage location.
3. Details on connectors for solids discharge chutes.
4. Equipment Weigh
5. Electrical control drawings
6. Drive motor data
7. A list of recommended Spare Parts, including any Special Tools required for routine maintenance of the equipment.
8. Certified copies of performance shop test data and reports shall be supplied for approval before shipment from the factory.

E. Operation and Maintenance (O& M) manuals shall describe the theory of the dewatering system, start-up, optimization, and maintenance operations for the equipment furnished and installed under this Section. The final O & M manuals shall be provided in digital format after equipment starts up in the close-out submittal process. The O & M manuals shall meet the requirements of Sections 013323 and 017823, including the following additional information:

1. As-Built Drawings of the Multi-Disc Screw Press.
2. Electrical diagrams
3. Controls and Accessories
4. Explanation of operating safety considerations
5. Repair Parts and maintenance materials
6. Troubleshooting data
7. Repair data

F. Warranty: The Equipment Manufacturer shall submit a warranty certificate for review. The date of the warranty begins after commissioning and operational demonstration and will be determined in the field by the Owner’s Engineer.

1.7 WARRANTY

A. The manufacturer shall warrant, in writing, that all equipment supplied by them shall be free from defects in material and workmanship, for a period of twelve (12) months from the date of startup, not to exceed eighteen (18) months from the date of delivery, unless noted otherwise within the specifications.

B. Any defects found within the warranty period shall be replaced if damaged or defective in the normal use of the equipment at no cost to the Owner.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 016600, Product Handling and Protection.

B. Equipment shall be shipped and delivered fully assembled, except where partial disassembly is required in order to conform to transportation regulations or for the protection of components.

C. Handling, delivery, and storage of the equipment shall be in accordance with the Manufacturer's recommendations. No extra cost shall be charged to the Owner for the handling, delivery, or storage of the equipment.

D. The Contractor shall be responsible for unloading and shall have equipment on-site at the time of delivery, permitting proper hoisting of the equipment.

E. Acceptance at Site:

1. Inspect all equipment and materials against the reviewed Shop Drawings at the time of delivery.
2. Equipment and materials damaged or not meeting the requirements of the reviewed Shop Drawings shall be immediately returned for replacement or repair.
3. The Contractor shall notify the Manufacturer of any damages to equipment within 5 days to effect proper remedial action. Failure to notify the Manufacturer of

damage to equipment prior to unloading shall void all warranties pertaining to the subject equipment.

F. Storage and Protection: Store all equipment and materials in a dry, covered, ventilated location and protect from harm according to the manufacturer's instructions. Carefully prepare for storage and label all equipment and materials after they have been inspected.

1.9 SEQUENCING

A. Comply with Section 011100, Summary of Work.

B. The Contractor shall take special note that the City of Wheeling WWTP must remain in operation at all times unless outages are approved by the Owner.

1.10 SPARE PARTS

A. Furnish the following spare parts:

1. Spray wash system solenoid valve.
2. Conveyor motor and VFD
3. Two (2) conveyor liners
4. Control Panel spare parts

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with specified requirements, provide equipment supplied by one of the following manufacturers:

1. Esmil Group, Multi-Disc Screw Press, Model MDQ-506CS
2. Or an Engineer approved equal.

B. The sludge dewatering process, electrical, controls, and structural design have been based on the Esmil Group, Multi-Disc Screw Press, which serves as the Basis of Design. Other named or approved equals may differ in structural configuration, electrical power

characteristics, or control systems; however, all proposed equipment shall fully comply with the site-specific constraints identified in the Description of Work, Paragraph 1.2 E.

2.2 EQUIPMENT DESCRIPTION

A. Design Criteria:

1. The Screw Press shall be capable of continuous operation without clogging.
2. System shall be designed to operate in the environment for which it is intended, continuously or intermittently on demand, and shall perform the required dewatering operations without spillage of water or sludge beyond the nominal machine envelope.
3. The Screw Press shall be designed to adequately condition and dewater the sludge such that a dewatered sludge cake is produced that easily discharges from the dewatering drum, without binding or plugging.
4. The system shall operate without the need for operator attention other than periodic inspection and chemical replenishment.

B. General

1. The flocculated sludge is fed into the dewatering drum by self-flowing through feeding tubes. Filtrate seeps between the moving and fixed drum disks and drains out into the filtrate tray below the dewatering drum. Next, the filtrate is discharged from the drums through a filtrate discharge pipe and returned to the plant.
2. As the sludge moves through the drum, the water is removed through the gaps between the movable and fixed disks. In the thickening zone, water is removed from sludge by the gravity and pressure of the screw flights. In the dewatering area, sludge is compressed due to the reduction of the space between the screw flights and the conical shape of the shaft.
3. The final compression of sludge occurs at the end of the dewatering area by an adjustable dam plate mounted on the outlet end of the screw. Through a gap between the plate and the drum end, the dewatered sludge is squeezed out of the drum into a container.
4.

C. The Dewatering Screw Press shall be a complete prefabricated system as described herein and shown on the Drawings, consisting of the following:

1. Flocculation and dosing Chamber:

a. Installed on the separated frame.

b. Sludge conditioning system consists of a flocculation chamber with a mixer (agitator) with an electric drive-motor, which allows efficient mixing of polymer solution with the initial sludge. Mixer is equipped with two adjustable blades to perform the proper flocculation process.

c. The flocculation and dosing tank frame is equipped on both sides with eyelets for transportation and holes for anchoring to the concrete base.

d. The flocculation and dosing chamber shall be equipped with steps to facilitate operator access to the top of the tank for effective supervision of the flocculation process.

e. The flocculation and dosing chamber shall be equipped with a junction box to enable the connection to the main Screw press control panel.

2. Six (6) horizontal dewatering drums with drive-motors, including an individual rinsing water system with nozzles. Each dewatering drum shall have individual fixing elements that can be removed separately while other screws are in operation.

a. The dewatering drum consists of a variable flight pitch screw located within a support frame of alternating fixed and moving discs. Fixed discs are equipped with built-in spacers that hold the fixed discs apart and provide a gap for moving discs between them.

b. The feed tubes connect the mixing tank with the dewatering drums.

c. A spring-loaded dam plate at the end of the drum sets the gap from where the cake exits, providing the back pressure that forces final sludge dewatering.

d. Machine frame structure for the dewatering drums includes a filtrate collection tray and outlet flanges. The frame is equipped on both sides with eyelets for transportation and holes for anchoring to the concrete base.

e. A self-contained electrical and control panel, including control and monitoring of ancillary equipment such as main equipment: sludge feed pump, polymer preparation and feed equipment, and dewatered sludge cake conveyor for sludge removal equipment, and a flowmeter

D. Manufacturer shall provide a Flowmeter to control influent sludge flow to the Screw Press, installed as shown on the Drawing. The Flowmeter shall be the electromagnetic type, by Endress Promag W400, or equal. The flowmeter shall have 4-inch flanges, ANSI 150 lbs, and an NEMA 4X enclosure.

2.3 MATERIALS OF CONSTRUCTION

A. All materials utilized in the construction of the sludge dewatering equipment shall be entirely suitable in every respect for the service required. All metals in contact with polyelectrolyte or sludge, and all other metal components other than those specified in the table below, shall be stainless steel, type 304 or 316, or plastic.

B. The following table provides the materials and coatings that shall be provided for the Screw Press and related components unless specified otherwise herein:

Equipment	Material
Mixing tank with frame base	Type AISI 304 stainless steel
Rinsing water spray pipes	Type AISI 304 stainless steel, plastic
Technological pipes	Type AISI 304 stainless steel, plastic
Dewatering drum	Type AISI 304 stainless steel
Dewatering drums enclosure and cover	Type AISI 316L stainless steel
Dewatering drum screw	Type AISI 304 stainless steel with FREA-metal blade edge
Gearmotor	Cast iron
Gearmotor coating	Acrylic paint
Spray nozzles	Plastic
Electrical enclosure	Carbon steel with acrylic paint or AISI 304 stainless steel
Electrical wiring housing	Non-metallic flexible liquid-tight conduit and fittings
Valves: wetted sections	Stainless steel or brass, EPDM seating

C. No carbon steel shall be used for any part of the Screw Press.

2.4 STRUCTURAL COMPONENTS

A. The structural support frame shall be fabricated of type 304 stainless steel. It shall be a rigid structure, adequately braced to withstand intended loads without excessive vibration or deflection.

B. The framework shall be of welded and/or bolted construction. The structure shall be designed for installation on a prepared concrete foundation and secured with anchor bolts.

2.5 DEWATERING DRUMS

A. The dewatering drums shall be constructed of ASTM type 304 Stainless Steel. All circular components shall be laser cut to ensure maximum evenness of wear and operating life. The dewatering drum consists of a screw shaft rotating at a variable speed in the cylindrical body. The body consists of a support structure and a series of alternating fixed and movable disks with gaps between them. In the thickening zone, the gap between the fixed and moving discs is 0.020. In the dewatering zone, the gap decreases from 0.012 to 0.006 inches as the sludge is transported further down the drum. Nominal drum size shall be 20 inches.

B. Each dewatering drum must have a minimum internal volume of 16 cubic feet. The maximum operational speed of the dewatering drums must not exceed 2.5 rpm at the design loading.

C. Screw flights side shall be protected by welded hard metal strips “frea-metal” with a thickness of not less than 0.05 inches. Vickers hardness of the metal strips shall be not less than 600 HV.

D. Screw shaft has a conical shape with a diameter increasing from the initial sludge inlet zone to the cake discharge zone for DS content increase in the dewatered sludge.

E. Assembly shall be undertaken in such a way that all fixed discs are concentric and parallel. The thickness of both fixed and moving discs shall be no less than 0.114″ in the thickening zone and 0.136″ in the dewatering zone. Discs shall be evenly spaced within each section of the dewatering drum. Spacers shall be integrated into the fixed discs via threaded connections; the use of separate spacers is not permitted. All discs shall be made of AISI 304 stainless steel; plastic discs are not allowed. Moving discs shall be replaceable and designed for a service life of no less than 15,000 operating hours.

F. All fixed discs shall be mounted on a single, rigid support frame forming an integral assembly. Designs utilizing threaded rods, tie rods, or any similar components within the drum for disc support, alignment, or spacing shall not be accepted.

G. The dewatering drum shall be installed in a horizontal position with two mounting points to the unit frame – at the sludge inlet zone and at the cake discharge zone. Intermediate fixation points along the drum are not allowed. Each drum can be removed separately while the other screws remain in operation.

H. Cake Dam Plate shall be spring-loaded, self-adjusting, and fabricated from AISI 304.

I. Each dewatering drum shall be equipped with an individual spray bar. Each spray bar shall consist of a spray pipe fitted with spray nozzles, located above the dewatering drum. The spray pipe and spray nozzle assembly shall be readily removable. Nozzle spacing and spray pattern shall be such that the sprays from adjacent nozzles overlap one another on the dewatering drum surface. The sprays shall operate periodically and shall partly remove solids built up externally on the drum, such that over time no significant buildup of solids occurs on the drum. Each spray bar shall be equipped with a solenoid valve.

1. Nominal rinsing water consumption: 29 gpm
2. Nominal rinsing water pressure: 30-60 psi
3. Typical total consumption: 150 gph for 6 dewatering drums

J. Each Dewatering Drum shall have a drive motor:

1. The Dewatering Drum drive motor shall be a one-piece gear-motor.
2. Gear-motors shall be hollow shaft design, designed to drive the dewatering drum screws with no additional couplings or joints. Motors shall be filled with grease on assembly and sealed for life. Screw rotational speed shall be obtained through a reduction gear. Input power to the dewatering drum drive shall be supplied through an A.C. variable frequency drive unit.
3. Drive Motor Data:

a.	Maximum Horsepower:	3 Hp
b.	Power Requirements:	460 VAC, 3-phase, 60 Hz
c.	No load motor speed:	1765 RPM, VFD
d.	Gear Reduction:	435.50:1
e.	Max output shaft speed:	4.1 RPM @ 60Hz

f. Insulation Class: NEMA 4

g. Enclosure: TEFC

h. Enclosure material: Painted Cast Iron

2.6 FLOCCULATION CHAMBER

A. The Screw Press has a mixing system equipped with an electric agitator with a gearmotor. The agitator has two adjustable blades. Tank dimensions and design shall ensure adequate residence time and mixing conditions to ensure complete flocculation and satisfactory dewatering performance. Tank design shall minimize the possibility of any short-circuiting of flow.

B. Design and manufacture of the chamber shall ensure no leakage of fluids under normal working conditions.

C. The flocculation chamber shall be manufactured in type AISI 304 Stainless Steel.

D. The flocculation chamber shall be equipped with a conductometric level sensor for emergency level and a pressure sensor for flow control.

E. Each agitator shall have a drive motor:

1. The agitator drive motor shall be a one-piece gearmotor. The gear-motor shall be a hollow shaft type, designed to drive the agitator with no additional couplings or joints. Motor shall be filled with grease on assembly and sealed for life. Screw rotational speed shall be obtained through a hypoid reduction gear. Input power to the agitator drives shall be supplied through an AC variable frequency drive unit.
2. Agitator gearmotor data:

a. Maximum Horsepower: 4 Hp

b. Power Requirements: 460 VAC, 3-phase, 60 Hz

c. No load motor speed: 1760 RPM, VFD

d. Gear Reduction: 95.56:1

e. Output shaft speed: 18 RPM @ 60Hz

f. Insulation Class: F

g. Enclosure: TEFC

h. Enclosure material: Painted Cast Iron

2.7 CONTROLS

A. The Screw Press shall have an integrated electrical control system that shall allow for safe, simple, and automated operation of the unit. The electrical control system shall have statuses for the unit in operation and unit alarms to an external plant SCADA system. External SCADA system connections shall be via fiber and allow monitoring of status and alarms for all system components available at the local control system, at a minimum.

B. Control Panel Features:

1. Refer to Section 330900 PLC and HMI Control system for panel requirements.
2. Variable frequency drives (VFD) shall be provided for the dewatering drums, agitator gearmotors, and conveyor.
3. The control panel shall be capable of receiving and processing all input signals and output signals to and from the equipment.
4. Control Panel shall be capable of receiving and processing all input and output signals “To” & “From” the equipment specified in this Section

    a. The table below includes, but is not limited to, a summary of additional I/O points to be directly monitored or controlled by the Multi-Disc Screw Press:

Signal Description	**Signal Type**	**I/O Type**
External Sludge Pump #1 - Start/Stop Command	Control	N/O Output
External Sludge Pump #1 - Running Feedback	Status	DI
External Sludge Pump #1 - Fault Feedback	Status	DI
External Sludge Pump #1 - In Remote Feedback	Status	DI
External Sludge Pump #1 - VFD speed Command	Control	AO
External Sludge Pump #2 - Start/Stop Command	Control	N/O Output
External Sludge Pump #2 - Running Feedback	Status	DI
External Sludge Pump #2 - Fault Feedback	Status	DI
External Sludge Pump #2 - In Remote Feedback	Status	DI
External Sludge Pump #2 - VFD speed Command	Control	AO
External Polymer Blending Skid #1 - Start/Stop Command	Control	N/O Output
External Polymer Blending Skid #1 - Running Feedback	Status	DI

External Polymer Blending Skid #1 - Common Alarm	Status	DI
External Polymer Blending Skid #1 - In Remote Feedback	Status	DI
External Polymer Blending Skid #1 - Speed Command	Control	AO
External Polymer Blending Skid #2 - Start/Stop Command	Control	N/O Output
External Polymer Blending Skid #2 - Running Feedback	Status	DI
External Polymer Blending Skid #2 - Common Alarm	Status	DI
External Polymer Blending Skid #2 - In Remote Feedback	Status	DI
External Polymer Blending Skid #2 - Speed Command	Control	AO
Screw Press System Alarm & Data to Plant SCADA System	Status	Fiber
Inlet Sludge Flow Meter	Control	AI

5. A programmable logic controller (PLC) shall control all timing and switching functions.
6. The contractor shall furnish, install, and commission a vendor Main Control Panel (VCP) that includes the PLC, HMI, and VFDs / motor starters as outlined. Refer to Section 330900 PLC and HMI Control system for panel requirements. The panel shall include, but not be limited to: VFDs / motor starters as outlined, power supply, main 3-phase disconnect, C/W front door handle, breakers, fuses, line reactors, terminals, etc. Provide adequate panel heating/cooling to meet the panel interior components' environmental requirements. All VFDs shall communicate with the Remote PLC Panel via Ethernet. Each VFD shall have a front door-mounted HIM module. Each motor (VFD/Motor Starters) shall have a front door-mounted HOA with a green run indicator light and a red fault indicator. VFD manufacturer shall be A-B PowerFlex or an approved equivalent.
7. The contractor shall furnish, install, and commission a separate vendor local control panel (VLCP) panel with HMI mounted on the skid for operator control. Refer to Section 330900 PLC and HMI Control system for panel requirements.
8. It is preferred that the operator can run the Screw Press in manual mode in the event the PLC fails. If this is not possible, inform Verdantas during the quote submission.

C. External Enclosure Features:

1. The external door of the control panel shall have the following switches and indicators:

    a. Main disconnect switch.

b. An emergency stop button which shall be a mushroom head style pushbutton that, when depressed, shall immediately de-energize all moving equipment in the system.

2. Refer to Section 330900 PLC and HMI Control system for panel requirements.
3. An H-O-A system switch to switch the system from HAND (Manual) to OFF to AUTO modes. In HAND mode, the HMI shall include manual (local) control of all motors controlled by the Press Control System.

2.8 PROGRAMMABLE LOGIC CONTROLLER (PLC)

A. Refer to Section 330900 PLC and HMI Control system for PLC requirements.

B. The Screw Press shall be provided with a PLC, installed, wired, and programmed to perform the listed functions. The PLC shall be a standard unit with no specialist hardware or firmware modifications. Full application software will be generated by the Screw Press manufacturer to operate the dewatering system using the PLC manufacturer's proprietary software package.

1. Operational Control

   a. Control of all components of the dewatering system, including the ability to set times, operation, and operating speeds or capacities for the sludge dewatering press feed pump, discharge sludge cake conveyors, dewatering drums, mixers, polymer blending and feed system, and wash-down sprays.

2. System Tuning:

   a. PLC shall allow suitably qualified operators to adjust operating parameters such as delay timers for fault alarms and system calibration constants.

3. Monitoring Operation:

   a. PLC shall allow the operator to inspect the operation of all the components, including indicators such as output speed or capacity, elapsed operating times, and any faults present.

   b. Operators shall be able to view approximated readouts of all operational speeds and flow rates relevant to the operation of the system.

4. Manual Operation of Components:

a. Operators shall be able to operate each item of equipment manually from the PLC/HMI interface for inspection and maintenance reasons.

5. Time Clocks:

a. Operator shall be able to set the unit to operate at a specific time or on specific days with no operators present.

6. The PLC shall include an Ethernet port for communications and for importing and exporting all dewatering system equipment data from/to the plant SCADA system over Fiber.
7. The PLC shall be capable of monitoring, recording, and outputting all input and output status parameters noted herein to the HMI and the plant SCADA system.
8. The PLC shall be capable of monitoring, recording, and outputting all alarm conditions to the plant SCADA system.

2.9 FUNCTIONAL DESCRIPTION

A. The control panel shall undertake the following operations:

1. Auto-Manual Operation: The Screw Press system shall be able to be set to either AUTO, MANUAL, or OFF on the control panel.

a. When set to manual, all items must be switched ON and OFF at the control panel by the switches on the HMI unit.

b. When set to OFF, no items shall work whether switched ON or OFF, either at the control panel or anywhere else.

c. When set to AUTO, all items of equipment shall be turned ON into work as per the following descriptions:

1) Under this mode of operation, the Screw Press will run constantly and will shut itself down in the event of any malfunctions detected by the control system. The Screw Press should always be run in automatic mode.

2) Turn automatic mode on by switching the three-position selector switch H-O-A to the automatic position and pressing the automatic mode button on the touch panel.

3) A mixer drive in the flocculation chamber switches “ON” in automatic mode.

4) The screws' drives are switched on when the preset sludge level in the flocculation chamber is reached.

5) Also, after the screws' drives are switched on and subsequently operated in the automatic mode, rinsing valves will be activated periodically, according to the predefined stop and start intervals. If there is more than one valve, only one valve opens at a time to reduce the instantaneous water requirement.

d. Additionally, to "AUTO" mode operation activated by the personal, there must be automatic, auto mode activation scenarios:

1) AUTO mode: sludge level control.

2) AUTO mode: flow control.

3) AUTO mode: conveyor

4) AUTO mode: Polymer

e. Influent sludge feed pump and polymer feeder switch ON after the predetermined delay time, counting from the moment of turning automatic mode on.

B. The control panel shall provide signals to allow for all input and output parameters and alarms to be taken directly from the Screw Press control panel to the plant SCADA system. Provide a list of addresses for all parameters and alarms. The Plant SCADA system will not monitor the system parameters as a part of this scope, but shall provide the capability for future use.

2.10 ELECTRICAL HARDWARE

A. Power wiring shall be 460VAC, type SIS insulation, stranded copper, and shall be sized for the required load, 12AWG minimum.

B. Control wiring shall be 24VDC, type SIS insulation, stranded copper, and shall be sized for the required load, 18AWG minimum.

C. Main three-pole switch disconnector Allen Bradley or equal. Circuit breakers shall be LOVATO or equal.

D. Motor starters shall be full voltage, non-reversing, IEC style across-the-line units. Coils shall be 24VDC. Schneider Electric type or equivalent.

E. Selector switches shall be heavy-duty, corrosion-resistant units rated for NEMA 4X service. Contact blocks shall be rated for 10A continuous service. Selector switches shall be Harmony XB4 series Schneider Electric or equal.

F. Pilot lights shall be heavy-duty, corrosion-resistant units rated for NEMA 4X service. Units shall be 24VDC full voltage incandescent type. Pilot lights shall be Harmony XB7 series Schneider Electric or equal.

G. Terminal blocks shall be high-density, solderless box lug style, with a 600-volt rating. Terminal blocks shall be Wago, Wieland type, or equal.

H. Control relays shall be general-purpose type with a 6A contact rating, miniature square base, and an internal on status pilot light. Relays shall be Schneider Electric Type RXM4 Series or equal.

I. Programmable Logic Controller (PLC) shall be Allen-Bradley.

J. Variable Frequency Drives (VFD) shall be UL-listed and shall be manufactured by Allen-Bradley.

PART 3 - EXECUTION

3.1 INSTALLATION (FUTURE CONTRACT)

A. Equipment shall be installed in accordance with the Manufacturer's recommendations to provide a complete installation.

B. All lubrication required for initial operation shall be furnished and applied in accordance with the Manufacturer's recommendations.

C. It is the intent of this Contract that the final installation shall be complete in all respects, and the Contractor shall be responsible for minor details and any necessary special construction not specifically included in the drawings or specifications.

D. Equipment shall be installed in strict conformance with the manufacturer’s installation instructions, as submitted with Shop Drawings, Operation and Maintenance Manuals, and/or any pre-installation checklists.

E. Anchor bolts size shall be per the manufacturer's recommendation. Anchors, anchor bolts, nuts, and washers shall be 316 stainless steel and furnished for each item of equipment by the Contractor.

1. Anchor bolt template drawings shall be included in the submittal to permit verification of the location of structural elements, new or existing, in the concrete.
2. Equipment manufacturers shall specify the ample size and strength required to securely anchor each item of equipment. Anchor bolt template drawings shall be included in the submittal to permit verification of the location of structural elements, new or existing, in the concrete.
3. Equipment shall be placed on the foundations, leveled, shimmed, bolted down, and grouted with a non-shrinking grout.

3.2 ELECTRICAL CONNECTIONS AND CONTROLS (FUTURE CONTRACT)

A. Wiring and conduits for electrical power, control, and instrumentation will be provided as shown in the Drawings and under Division 26 – Electrical.

3.3 TESTING (FUTURE CONTRACT)

A. After completion of the installation, the equipment shall be tested by the Contractor in the presence of the Engineer under actual operating conditions. The test shall be conducted under the supervision of the manufacturer's technical representative and shall demonstrate that the equipment is fully operational by picking up and depositing materials into the specified containment.

B. Field certification shall include inspection of the following:

1. Verify equipment is properly aligned and anchored per the installation instructions and drawings. Assure all piping and valves are installed and properly connected, and the dewatering equipment is unobstructed with required clearances maintained.
2. Assure controls and instrumentation work in all modes.
3. Check equipment for proper operation as well as completion of the Start-Up requirements in the installation guide.

C. Performance Testing.

3.4 EQUIPMENT MANUFACTURER'S SERVICE REPRESENTATIVE (FUTURE CONTRACT)

A. After completion of the installation, the equipment shall be tested by the Contractor in the presence of the Engineer under actual operating conditions. The test shall be conducted under the supervision of the manufacturer's technical representative.

B. The equipment system supplier shall furnish the services at the site of a factory-trained representative for a period of three (3) to eight (8) working hours to the job site. Service shall be provided after the Contractor has installed the equipment. These services shall be furnished for:

1. The equipment manufacturer’s inspection of the equipment following installation by others, and to certify that the equipment has been properly installed and is ready to operate.
2. Conduct the equipment Performance Testing.
3. To train the Owner’s personnel in the operation and maintenance of the equipment, and to observe and supervise the initial operation of the equipment.

C. If additional service is required due to the mechanisms not being fully operational, at the time of service requested by the contractor, the additional service days will be at the contractor's expense.

D. After inspection of the installed equipment, the Supplier shall furnish a written report certifying that the equipment has been properly installed and lubricated, is in accurate alignment, is free from any undue stress imposed by connecting piping or anchorage, has been operated under full load conditions, and that it operates satisfactorily.

3.5 DEMONSTRATION AND INSTRUCTIONS (FUTURE CONTRACT)

A. Provide the services of a qualified factory-trained manufacturer’s representative to conduct training covering operation, mechanical maintenance, electrical requirements, troubleshooting, etc.

3.6 OPERATION AND MAINTENANCE MANUALS

A. Prior to or with the delivery of equipment, the manufacturer shall provide copies of an operation and maintenance manual, including storage, installation, start-up, operating, and maintenance instructions, and a complete parts list and recommended spare parts list. The O & M manuals shall be in compliance with the General Requirements.

B. Provide a complete P&ID in an 11 x 17 PFD of the system.

END OF SECTION 467331